Regina Ortmann

The Impact of a Harmonized European Corporate Tax Base on Investment Decisions of Multinationals

Thesis

Regina Ortmann

The Impact of a Harmonized European Corporate Tax Base on Investment Decisions of Multinationals

Preface/Vorwort

Die vorliegende Arbeit habe ich als Doktorandin im Doctoral Program in International Business Taxation (DIBT) an der Wirtschaftsuniversität Wien geschrieben. Das DIBT hat mir ein tolles Umfeld geboten um mich fachlich, akademisch und auch persönlich zu entwickeln. Insbesondere möchte ich meiner akademischen Lehrerin, Frau Prof. Dr. Caren Sureth-Sloane, danken, die mir überhaupt erst die Möglichkeit einer Promotion im Rahmen des DIBT eröffnet hat. Sie hat mich stets sowohl fachlich als auch persönlich unterstützt und hat mir immer wieder wichtige Impulse gegeben, die mich in meinem akademischen Werdegang voran gebracht haben. Nicht zuletzt danke ich ihr auch für die Möglichkeit meine Dissertation an ihrem Lehrstuhl an der Universität Paderborn als wissenschaftliche Mitarbeiterin ab Dezember 2014 abzuschließen.

Des Weiteren gilt mein Dank Herrn Prof. Dr. Michael Lang und Herrn Prof. Dr. Dirk Kiesewetter, die das Zweit- und Drittgutachten zu meiner Dissertation angefertigt haben und Frau Prof. Dr. Eberhartinger, Herrn Prof. Dr. Jens Müller, Herrn Prof. Dr. Josef Schuch und Herrn Prof. Dr. Rupert Sausgruber, die als Mitglieder des Defensiokomitees meine Arbeit kritisch durchleuchtet haben. Besonders danken möchte ich auch Prof. Dr. Edward Maydew für meinen Forschungsaufenthalt an der Kenan-Flagler Business School der University of North Carolina at Chapel Hill.

Zudem möchte ich mich bei meinen Kollegen aus dem DIBT bedanken, mit denen ich drei aufregende Jahre verbracht habe und die mir stets unterstützend zur Seite gestanden sind. Stellvertretend für viele liebgewonnenen Kollegen aus Wien möchte ich an dieser Stelle Julia Braun, Daniel Fuentes, Alejandro Ruiz, Raffaele Petruzzi und Felipe Vallada nennen. Auch meinen Kollegen von der Universität Paderborn möchte ich herzlich für ein tolles Arbeitsumfeld und für all die moralische und fachliche Unterstützung danken. Insbesondere bedanke ich mich bei Thomas Hoppe, Stephan Alberternst, Fabian Failenschmid und Vanessa Hennemann.

Mein ganz besonderer Dank gilt meiner Familie und meinen Freunden. An erster Stelle bedanke ich mich bei meinem Vater, der mich in jeglicher Situation unterstützt hat. Zudem hat Christian Ewers sehr viel zum erfolgreichen Abschluss meiner Promotion beigetragen, wofür ich ihm sehr dankbar bin. Danken möchte ich auch allen Freunden für ihre moralische Unterstützung, allen voran Anne Ewers und Philipp König.

Dankeschön!

Oberhenneborn, im Dezember 2015

Regina Ortmann

Contents List

Abstracts

Can the CCCTB Alleviate Tax Discrimination against Loss-making European Multinational Groups?

Regina Ortmann and Caren Sureth-Sloane

In March 2011, the European Commission submitted a proposal for a Council Directive on an optional common consolidated corporate tax base (CCCTB). If this proposed CCCTB system comes into force, taxes calculated under the currently existing system of separate accounting might be replaced by a system of group consolidation and formulary apportionment. Then, multinational groups (MNGs) would face the decision as to whether to opt for the CCCTB system. Prior research focuses mainly on the differences in economic behaviour under both systems in general. By contrast, we study the conditions under which one or the other tax system is preferable from the perspective of an MNG, with a particular focus on loss-offsets. We identify four effects that determine the decision of an MNG: the tax-utilization of losses, the allocation of the tax base, the dividend and intragroup interest taxation. We find mixed results, e.g., that the CCCTB system proves advantageous for increasing loss/profit streams (e.g. from start-ups or R&D projects) of the individual group entities, whereas the system of separate accounting is beneficial for decreasing profit/loss streams (e.g. caused by a decrease in return from a mature product). The results of our analysis are helpful for MNGs facing the decision as to whether to opt for the CCCTB system and can also support legislators and politicians in the EU but also in other regions in their tax reform discussions.

Uncertainty in Weighting Formulary Apportionment Factors

How does weighting uncertainty impact after-tax income of multinational groups?

Regina Ortmann

Formulary apportionment is an intensively debated mechanism for allocating tax base within multinational groups. Systems under which the formula is identical in all jurisdictions and systems under which jurisdictions can determine the weights on the formula factors individually can be observed. The latter systems produce uncertainty about the overall tax-liable share of the future group tax base. Counter-intuitively, I identify scenarios under which

increased uncertainty leads to higher expected future group income. My results provide helpful insights for firms and policy makers debating the specific design of a formulary apportionment system.

Formula Apportionment or Separate Accounting? Tax-Induced Distortions of Multinationals' Locational Investment Decisions

Regina Ortmann and Erich Pummerer

We examine which tax allocation system leads to more severe distortions with respect to locational investment decisions. We consider separate accounting (SA) and formula apportionment (FA). The effects of both systems have been hotly debated in Europe in the past years. The reason is that the EU Member States are striving to implement a common European tax system that would lead to a switch from SA to FA. While existing studies focus primarily on the impact of taxes on locational decisions under either SA or FA, the main innovation of this paper is that it compares both systems with regard to the level of distortions they induce. We compare the optimal pre-tax investment decision with the optimal after-tax investment decision and infer from the difference in the allocation of investment funds which tax allocation system causes more severe distortions. We assume that the multinational group (MNG) has comprehensive book income shifting opportunities under SA. We find that the investment incentives under SA are opposed to those under FA for a profitable investment project. Whereas under SA as much as possible should be invested in a high-tax country, under FA as much as possible should be invested in a low-tax country. The distortions of locational investment decisions tend to be more severe under SA than under FA if a greater share of investment funds is to be invested in a low-tax country from a pre-tax perspective and the investment is profitable. Vice versa, locational decisions may be more distorted under FA if the optimal pre-tax investment decision requires investing a major share of funds in the high-tax country. In contrast to the often stated insensitivity of FA towards income shifting, we find the introduction of a tax allocation system based on FA in Europe could lead to a severe shift of economic substance to low-tax countries. The results of this paper are of particular interest for European policy makers and MNGs as our findings may induce European MNGs to reassess their recent locational investment decisions in the face of a potential future change in the applied tax allocation system.

The Impact of a Harmonized European Corporate Tax Base on Investment Decisions of Multinationals: Introduction

Regina Ortmann

"The creation of a completely new and harmonized tax system is a golden opportunity to* rethink the fundamentals and to provide *much needed simplicity."

Jesper Barenfeld on the CCCTB,
Tax Policy Adviser, Confederation of Swedish Enterprise, 2007[1]

The single market is seen as Europe's greatest achievement. It allows the free movement of capital, goods, people, and services and thereby offers great opportunities for people and businesses.[2] The regulatory environment within the European Union (EU) directly impacts investments, jobs, and growth in the EU.[3] Whilst the creation of the European Single Market has been successful in many respects,[4] there are still some shortcomings. A study[5] shows that removing institutional obstacles and creating a pure single market could generate benefits amounting to € 1.467 billion per year. What is more, exploiting the full growth potential of the single market could exceed over 11% of EU GDP.[6]

Non-uniform corporate taxation across EU member states is one such obstacle to the single market. Multinational groups (MNGs) operating within the European Union face up to 28 different and overlapping tax jurisdictions. The complexity caused by such a "patchwork of national tax systems within the EU"[7] often leads to over-taxation, double taxation, tax uncertainty, high administrative burdens, and enormous compliance costs.[8] These fiscal obstacles within the EU lead to a loss of economic efficiency[9] and disincentives for investing in the EU.[10]

---

[1] Barenfeld (2007), p. 258.
[2] See European Commission (2015a).
[3] See European Commission (2015b).
[4] See Massoner (2013), p. 1.
[5] See European Parliament (2014).
[6] See European Commission (2015b).
[7] Barenfeld (2007), p. 258.
[8] See European Commission (2011), p. 4.
[9] See Barenfeld (2007), p. 258.
[10] See European Commission (2011), p. 11.

To mitigate these and other fiscal hurdles in the single market, in March 2011 the European Commission proposed a directive on a Common Consolidated Corporate Tax Base (CCCTB). Under the CCCTB system, the taxable corporate income for businesses operating within the EU would be calculated according to a single set of rules. In other words, one common EU tax system would replace 28 different national tax systems. Furthermore, MNGs operating within the EU would only have to file one consolidated tax return. All profits and losses of the single entities would be consolidated on the group level. The consolidated tax base would subsequently be allocated to the single entities according to formula apportionment. The formula is proposed to consist of three equally weighted factors: assets, labor, and sales. Each Member State would then tax the profits at their own national tax rate.[11] The CCCTB is by far the largest reform project of the European Commission in the area of direct taxation.[12]

After 2011, however, the negotiations on the CCCTB project stalled largely[13] because of opposition from those member states that fear national disadvantages, e.g., in terms of national tax revenues. Nonetheless, in June 2015 the Commission announced in its Action Plan for Fair and Efficient Corporate Taxation to relaunch the CCCTB project. The CCCTB is considered "a holistic solution to the current problems with corporate taxation in the EU"[14] and "could serve as a powerful tool against corporate tax avoidance".[15] The re-launch of the CCCTB project is heavily motivated by the Action Plan on Base Erosion and Profit Shifting (BEPS) of the OECD.[16] The Action Plan aims at creating a taxation environment that ensures that companies pay a fair share of taxes in the countries in which they operate. The BEPS project is of major importance for MNGs and would deliver "the most fundamental changes to international tax rules in almost a century".[17] According to the European Commission, the CCCTB system would provide an adequate framework for the member states to tackle BEPS.[18]

In connection with the re-launch the Commission is amending its original CCCTB proposal and plans to present it in 2016. The Commission will propose a CCCTB that is mandatory at least for MNGs.[19] The proposal will incorporate a step-by-step approach that breaks down the implementation of the CCCTB into smaller, more easily manageable stages. Thus, the CCCTB

[11] See European Commission (2015c).
[12] See Massoner (2013), p. 1
[13] See European Commission (2015c).
[14] European Commission (2015c).
[15] European Commission (2015c).
[16] See OECD (2015).
[17] See PwC (2014).
[18] See European Commission (2015d).
[19] See European Commission (2015d).

shall be implemented initially without the key element of consolidation. Consolidation would be introduced in a second step once the common base is secured.[20] The planned adaptation of the proposal reflects the difficulties associated with its feasibility. The Commission states clearly that the original CCCTB proposal from 2011 was "too ambitious to be adopted in a single step".[21] It admits further that "[d]iscussions on more difficult aspects of the proposal – notably consolidation – are holding back progress on other important areas which could be agreed more quickly". That statement clearly shows that many unresolved and technically complex questions are connected with the consolidation element of the CCCTB, which has yet not been sufficiently investigated.

While my dissertation is mainly motivated by the reform discussions in Europe, there are also other regions in the world that have established systems based on formula apportionment. The worldwide application of formula apportionment was even discussed by the OECD as an alternative to the arm's length principle.[22] However, it was rejected by the OECD member countries. They were concerned, inter alia, about the design of the apportionment formula which would lead to single taxation (as opposed to double taxation) and the abandonment of the single-entity approach with respect to the consolidation of profits and losses. Again, echoing the concerns of the EU member states with respect to the CCCTB, the objections of the OECD member countries show that further analysis is required of the effects of the consolidation element.

In North America, formula apportionment has been applied on the state level (US) or on the province level (Canada) for decades. Moreover, it is applied in Germany for trade taxation purposes and in China for enterprise income taxation[23] of companies with branches in various regions. Although these formula apportionment systems are applied at subnational level, the EU can learn from the experiences gained in these countries. Especially those in the US are relevant to the EU as the apportionment formula applied there is very similar to the proposed formula under the CCCTB system. In fact, studies on the US formula apportionment system provided valuable insights for this dissertation.

[20] See European Commission (2015d).
[21] See European Commission (2015d).
[22] See OECD (2010).
[23] See Ma (2008).

Whereas my dissertation is written from a business perspective, most of the studies on formula apportionment take a public finance perspective. Accordingly, most of them examine the optimal apportionment formula design. The studies mentioned in the following focus merely on the US. For instance, Goolsbee and Maydew (2000) find empirically that a lower weighting of the labor factor increases manufacturing employment in the state in question. Hellerstein and McLure (2004) investigate in a normative study what the EU can learn from the experiences gained in the US with respect to the introduction of the CCCTB. They identify conceptual and measurement problems for all three apportionment factors. Anand and Sansing (2000) show in an analytical study that states weight the apportionment factors in such a way as to increase their individual wealth instead of social wealth. More research is needed on the effects of the formula design on MNGs from a business perspective to better understand MNGs' reactions. Especially the second article of my dissertation ("Uncertainty in weighting formulary apportionment factors") seeks to fill this gap, since I examine how uncertainty potentially produced by the formula design affects the after-tax income of MNGs.

Studies based on simulated European data aim at assessing the impact on revenue of the introduction of the CCCTB. Fuest et al. (2007) find that the CCCTB would, due to the consolidation of profits and losses, reduce the EU-wide tax base significantly. Specifically, Oestreicher and Koch (2011) find that the CCCTB would reduce member states' total tax revenues by around 4.5%. Moreover, in line with the approach of the first and third article of my dissertation, there are some analytical studies that contrast the CCCTB system with separate accounting with respect to certain characteristics. Again, writing from a public finance perspective, Nielsen et al. (2010) focus on capital formation, input choices, and tax revenues when tax rates change. They find that under certain conditions that switching from separate accounting to formula apportionment can reduce MNG's average tax rates. Gérard and Princen (2012) compare both systems in terms of their effects on cross-border distribution of investments and financing strategies. They identify a variety of profit-shifting options that are offered by each system. Some studies compare the systems from a business perspective. These studies are most related to my dissertation. For instance, Martini et al. (2012) analyze the impact of either system on investment and production decisions accounting for a centralized and a decentralized company structure. They find that under a centralized structure the investment in low-tax countries is higher. Moreover, Kiesewetter and Mugler (2007) investigate whether the introduction of the CCCTB would decrease the cost of tax planning strategies and find that in fact, these costs could rise.

As shown previously, there is scarce literature that compares both tax systems, yet as the key element of the CCCTB system (consolidation and formula apportionment) and its effects on company decision-making is highly complex, much more research on this topic is needed. So far only fragments of the key element has been studied. Even the EU member states and the OECD member countries have clearly voiced their uncertainty with respect to consolidation and formula apportionment. The three articles of my dissertation shed light on selected issues associated with consolidation under the CCCTB system and thereby contribute to a better understanding of the effects of consolidation.

My dissertation scrutinizes the implications of a harmonized European corporate tax system for firms' and businesses' decision-making. Specifically, I examine the cross-border consolidation of profits and losses, the design of the apportionment formula applied to allocate the consolidated tax base to single group entities, and the locational investment decisions that are mainly driven by the consolidation of the tax base and its allocation to the group entities. All of my analyses are conducted using model-theoretical methods and simulations, with a partial analytic, i.e., partial equilibrium business perspective is maintained throughout.

The first article is titled "Can the CCCTB Alleviate Tax Discrimination Against Loss-making European Multinational Groups?" and is co-authored by my supervisor Prof. Caren Sureth-Sloane. It has been accepted for publication in the Journal of Business Economics. The article is based on a combination of an analytical model and a numerical analysis. My contribution to the article consists of the basic development of the research idea and of the analytical model, reviewing the existing literature, interpreting the results, and writing major parts of the article. In this article we consider under which conditions temporarily loss-making European MNGs would be better off opting for the CCCTB system. This question is of particular interest in the aftermath of the financial and economic crisis, during which companies accumulated enormous amounts of loss carry-forwards. We compare the loss-offset opportunities under the CCCTB system with those under the system of separate accounting for varying profit/loss streams of the group entities.

We focus in our analysis on a Franco-German group since their national loss-offset provisions are quite distinct from those under the CCCTB system. Taking Germany and France as examples allows us to show the fundamental changes in loss-offsets that may result from the introduction of the CCCTB. In contrast to the loss-offset provisions under the CCCTB system, France and Germany allow for loss carry-backs but impose restrictions on loss carry-forwards.

In a subsequent step we broaden our analysis and account for various loss-offset provisions that are common in all EU countries.

We find that there are four effects that determine the advantageousness of the one tax system over the other, i.e., utilization of losses, allocation of the tax base to the groups' entities, and the taxation of interests and dividends. The CCCTB is the preferred system for an MNG if the group entities incur initial losses and then become profitable, which is typical for start-ups. In the opposite case – the entities incur profits and subsequently moderate losses – the system of separate accounting tends to be more beneficial. Such a development over time is typical, for example, for businesses that trade in mature products. If the net cash flows of both group entities are opposing in their time structure of losses and profits, the advantageousness of each tax system depends on the entities' respective profit/loss streams.

Note that in line with the proposed CCCTB directive from 2011, the first article was written under the assumption that an optional CCCTB system should be implemented in Europe. However, in June 2015 the Commission announced it would propose a mandatory CCCTB in 2016. Thus, basing the analysis on an optional CCCTB system may be outdated at this point in time. Nonetheless, the main contribution of the first article consists of a comparison of the tax systems with particular focus on loss offsets; the assumption of an optional CCCTB is a technical detail that does not diminish our contribution.

The second article is titled "Uncertainty in weighting formulary apportionment factors", with myself as sole author, and has been published in Business Administration Review, Issue 03/2015. Via a binomial model I examine how uncoordinated factor weights in the apportionment formula impact the expected future income of an MNG. The CCCTB system has not be introduced yet since the EU member states have found it very difficult to agree on a common formula. The proposed CCCTB directive suggests an equally weighted formula consisting of three factors: assets, labor, and sales. A possible way of fostering an agreement between the member states would be to authorize them to determine the weights on the factors on their own. The concept of individually determined factor weights has been implemented, e.g., in the US, where the states are free to choose their own factor weights. For the purpose of the article I distinguish between these two kinds of formula apportionment system. I study systems under which the formula is identical in all jurisdictions ("common system") and those under which jurisdictions are permitted to determine the weights on the formula factors individually ("individual system").

In contrast to the common system, more or less than 100% of the group tax base may be tax-liable under the individual system. Since jurisdictions are free to set the factor weights, the individual system produces uncertainty about the tax-liable share of the future group tax base. In this article I examine how this uncertainty impacts expectations concerning MNGs' future after-tax income. Counter-intuitively, I find that in the case of a positive first period's group tax base the (expected) future income under the individual system is even higher than under the common system and that greater uncertainty may lead to a higher expected future income.

The third article**,** titled "Formula Apportionment or Separate Accounting? Tax-Induced Distortions of Multinationals' Locational Investment Decisions", is co-authored with Prof. Erich Pummerer from the University of Innsbruck. It is published in the SSRN WU International Taxation Research Paper Series. We conduct a model-theoretical analysis. My contribution to the article consists of refining the analytical model, reviewing the existing literature, interpreting the results, and writing large parts of the article.

One reason that member states hesitate to agree on the CCCTB system is that they are unable to assess the real economic consequences of its introduction. We contribute to a better understanding of these consequences with respect to locational investment decisions and examine which tax allocation system (separate accounting or formula apportionment) most distorts MNGs' locational investment decisions. Formula apportionment is the tax allocation system that would be applied under the proposed CCCTB system, whereas separate accounting is the traditionally applied system in Europe. We assume that under separate accounting, the MNG can partially segregate the location of costs from the location of sales due to favorable transfer pricing arrangements. The optimal pre-tax investment decision is taken as a benchmark to assess the distortive power of either tax allocation system.

We find that the tax allocation systems offer opposing investment incentives for a profitable investment project. Under separate accounting the MNG would be best advised to invest all of its funds in a high-tax country, whereas under formula apportionment it should invest in a low-tax country. The locational investment decision tend to be distorted more severely under separate accounting than under formula apportionment, with better income shifting possibilities under separate accounting, with lower pre-tax profits of the investment project and if the biggest share of investment funds is invested in the low-tax country from a pre-tax perspective. Vice versa, locational decisions may be more distorted under formula apportionment if the optimal pre-tax investment decision requires investing a major share of funds in the high-tax country.

The introduction of a tax allocation system based on formula apportionment in Europe could lead to a severe shift of economic substance to low-tax countries.

The results of the three articles are of special interest for EU policymakers as they debate the design of a potential CCCTB system, in particular the consolidation element. The results help to anticipate how MNGs could react to the CCCTB system. Before estimating the tax revenue implications for the member states, the reactions of firms have to be carefully anticipated. The results are also relevant for MNGs in the EU as they inform them of the potential effects of the introduction of the CCCTB and thus are helpful in taking locational decisions. As stated above, tax systems based on consolidation and formula apportionment are also applied in other parts of the world, for example on the state level in the US or in Canada. Moreover, the findings also provide valuable input for tax reform discussions and debates on lowering regulatory barriers in other regions or markets in general.

Looking ahead, the taxation of MNGs will continue to be hotly debated by policymakers and companies in the EU and around the world. In a continuously changing world of business models and value chains, due to e.g., globalization, regulation, digitization and more, the concepts of taxation have to be adapted as well. In Europe, the CCCTB system is intended to deliver comprehensive solutions for future complex problems in taxation. The re-launch of the CCCTB project is fueling the debate on its two key elements, consolidation and formula apportionment. The findings discussed in this dissertation will advance the knowledge about harmonized tax systems and can contribute to those discussions.

References

Anand, Bharat N./Sansing, Richard (2000): The Weighting Game: Formula Apportionment as an Instrument of Public Policy. In: National Tax Journal, Vol. 53, pp. 183-200.

Barenfeld, Jesper (2007): A Common Consolidated Corporate Tax Base in the European Union – A Beauty or a Beast in the Quest for Simplicity? In: Bulletin for International Taxation, Vol. 61, pp. 258-271.

European Commission (2011): Proposal for a Council Directive on a Common Consolidated Corporate Tax Base, COM (2011) 121/4, Brussels.

European Commission (2015a): A deeper and fairer Single Market: Commission boosts opportunities for citizens and business. Web. 28 Oct 2015. http://europa.eu/rapid/press-release_IP-15-5909_en.htm (date of last access: 2 Nov. 2015).

European Commission (2015b): Factsheet 4: Improving the Investment Environment. http://ec.europa.eu/priorities/jobs-growth-investment/plan/docs/factsheet4-environment_en.pdf (date of last access: 2 Nov. 2015).

European Commission (2015c): Common Consolidated Corporate Tax Base (CCCTB). http://ec.europa.eu/taxation_customs/taxation/company_tax/common_tax_base/index_en.htm (date of last access: 2 Nov. 2015).

European Commission (2015d): Questions and Answers on the CCCTB re-launch. Web. 17 June 2015. http://europa.eu/rapid/press-release_MEMO-15-5174_de.htm (date of last access: 2 Nov. 2015).

European Parliament (2014): The Cost of Non-Europe in the Single Market. http://www.rand.org/content/dam/rand/pubs/research_reports/RR800/RR862/RAND_RR862.pdf (date of last access: 7 Nov. 2015).

Fuest, Clemens/Hemmelgarn, Thomas/Ramb, Fred (2007): How Would the Introduction of an EU-wide Formula Apportionment Affect the Distribution and Size of the Corporate Tax Base? An Analysis Based on German Multinationals. In: International Tax and Public Finance, Vol. 14, pp. 605-626.

Gérard, Marcel/Princen, Savina (2012): Investment and Financing Strategy of a Multinational Enterprise under Alternative Tax Designs. CESifo Working Paper No. 3838, Munich.

Goolsbee, Austan/Maydew, Edward L. (2000): Coveting they neighbor`s manufacturing: The dilemma of state income apportionment. In: Journal of Public Economics, Vol. 75, pp. 125-143.

Hellerstein, Walter/McLure, Charles E. (2004): The European Commission's report on company income taxation: What the EU can learn from the experience of the US states. In: International Tax and Public Finance, Vol. 11, pp. 199-220.

Ma, Shiqi (2008): New filing and payment rules for Enterprise Income Tax. IBFD, Tax research database. Amsterdam: International Bureau of Fiscal Documentation.

Martini, Jan T./Niemann, Rainer/Simons, Dirk (2012): Transfer Pricing or Formula Apportionment? Tax-induced Distortions of Multinationals´ Investment and Production Decisions. In: Contemporary Accounting Research, Vol. 29, pp. 1060-1086.

Massoner, Christian (2013): Konsolidierung im Rahmen der Common Consolidated Corporate Tax Base (CCCTB), LexisNexis Verlag, Vienna.

Kiesewetter, Dirk/Mugler, Jörg (2007): Gewinnverlagerung im EU-Konzern bei Besteuerung nach dem Trennungs- und nach dem Einheitsprinzip. In: Die Betriebswirtschaft, Vol. 67, pp. 503-518.

Nielsen, Søren B./Raimondos-Møller, Pascalis/Schjelderup, Guttorm (2010): Company Taxation and Tax Spillovers: Separate Accounting versus Formula Apportionment. In: European Economic Review, Vol. 54, pp. 121-132.

OECD (2010): Review of Comparability and of Profit Methods: Revision of chapters I-III of the Transfer Pricing Guidelines. http://www.oecd.org/ctp/transfer-pricing/45763692.pdf (date of last access: 7 Nov. 2015).

OECD (2015): About Base Erosion and Profit Shifting (BEPS). http://www.oecd.org/ctp/beps-about.htm (date of last access: 2 Nov. 2015).

Oestreicher, Andreas/Koch, Reinald (2011): The Revenue Consequences of Using a Common Consolidated Corporate Tax Base to Determine Taxable Income in the EU Member States. In: FinanzArchiv, Vol 67, pp. 64-102.

PwC (2014): OECD and BEPS - the most significant tax change in modern times. Web. 25 Sept 2015. http://pwc.blogs.com/north/2014/09/oecd-and-beps-the-most-significant-tax-change-in-modern-times-.html (date of last access: 2 Nov. 2015).

<u>Paper 1:</u>

Can the CCCTB Alleviate Tax Discrimination against Loss-making European Multinational Groups?

Regina Ortmann and Caren Sureth-Sloane

Can the CCCTB Alleviate Tax Discrimination against Loss-making European Multinational Groups?

Regina Ortmann* and Caren Sureth-Sloane**

Abstract

In March 2011, the European Commission submitted a proposal for a Council Directive on an optional common consolidated corporate tax base (CCCTB). If this proposed CCCTB system comes into force, taxes calculated under the currently existing system of separate accounting might be replaced by a system of group consolidation and formulary apportionment. Then, multinational groups (MNGs) would face the decision as to whether to opt for the CCCTB system. Prior research focuses mainly on the differences in economic behaviour under both systems in general. By contrast, we study the conditions under which one or the other tax system is preferable from the perspective of an MNG, with a particular focus on loss-offsets. We identify four effects that determine the decision of an MNG: the tax-utilization of losses, the allocation of the tax base, the dividend and intragroup interest taxation. We find mixed results, e.g., that the CCCTB system proves advantageous for increasing loss/profit streams (e.g. from start-ups or R&D projects) of the individual group entities, whereas the system of separate accounting is beneficial for decreasing profit/loss streams (e.g. caused by a decrease in return from a mature product). The results of our analysis are helpful for MNGs facing the decision as to whether to opt for the CCCTB system and can also support legislators and politicians in the EU but also in other regions in their tax reform discussions.

JEL classification: H25, H21

Keywords: Loss-Offset, CCCTB, Separate Accounting, Investment Decisions

Acknowledgments

We would like to thank Eva Eberhartinger, Edward Maydew, Richard Sansing, the participants of the 2013 American Accounting Association meeting, the participants of the Doctoral Workshop of the 2013 arqus meeting and the members of the DIBT Doctoral Program in International Business Taxation at Vienna University of Economics and Business for their helpful comments. Any remaining errors or inaccuracies are, of course, our own. Financial support from the Austrian Science Fund (FWF grant W 1235-G16) is gratefully acknowledged.

* Vienna University of Economics and Business, DIBT Doctoral Program in International Business Taxation, Department of Finance, Accounting and Statistics, Chair of Tax Management, Welthandelsplatz 1, 1020 Vienna, Austria, email: regina.ortmann@upb.de.

**University of Paderborn, Department for Taxation, Accounting, and Finance, Chair of Business Administration, especially Business Taxation, Warburger Straße 100, 33098 Paderborn, Germany, and Vienna University of Economics and Business, DIBT Doctoral Program in International Business Taxation, Vienna, Austria, email: caren.sureth@upb.de.

1 Introduction

In March 2011, the European Commission (2011) submitted a proposal for a Council Directive on a Common Consolidated Corporate Tax Base (CCCTB). If this directive comes into force, multinational groups (MNGs) operating within the EU would be able to opt for the CCCTB system and calculate their taxable profits on a consolidated basis. However, even if the proposed system were to reduce the over-taxation arising from the widespread application of the system of separate accounting (SA) currently in place in Europe, it would not necessarily always be advantageous for a European MNG to opt for the CCCTB system. To make the right choice, MNGs would have to weigh the advantages and disadvantages of the CCCTB system against those of the respective national laws that are crucial under SA. Especially, MNGs that comprise a mixture of profit and loss-making entities face a complex decision. Assuming the CCCTB system as outlined in the Council Directive, we identify factors that determine whether a European temporarily loss-making MNG should opt for the CCCTB system.

The differences in loss-offset regulations under the system of SA and under the CCCTB system constitute an important trade-off that is crucial for the advantageousness of either system. Whereas under the CCCTB system MNGs can make use of the cross-border loss-offset, it does not allow parent companies and subsidiaries carrying losses backward. By contrast, some European countries do allow loss carry-backs under their domestic laws. However, the vast majority has not implemented cross-border loss-offset provisions. Furthermore, losses can be carried forward indefinitely under the CCCTB system, whereas in many EU countries loss carry-forwards are either limited in amount or time. Beside the loss-offset provisions, other tax base effects matter as well and make the decision even more complex. Tax base effects emerge, e.g., from a deviating allocation of taxable profits to each country across the respective countries or from a differing treatment of intercompany interest payments and dividends under both systems. Against this rather complex background it is important to investigate under which conditions which of these two systems causes a lower tax burden for MNGs than the other.

We model different combinations of profit/loss streams for a European MNG. The time patterns and magnitudes of the profits and losses are key determinants of the advantageous nature of one tax system over the other. In a first step, as an example and to model common loss-offset rules, we examine an MNG domiciled in France and Germany. We select these countries as representative examples for two reasons. First, Germany and France are the biggest economies in the EU (see The World Bank 2012) and second, the implementation of a CCCTB between those two countries is more likely than between any other EU countries. France and Germany have already attempted to establish a bilateral CCCTB (see German Federal Ministry of Finance 2012). Since the loss-offset rules in France and Germany are highly specific we extent in a next step the scope of our analysis for tax system characteristics common in other EU Member States. We generalize our model for different types of loss-offset provisions that are representative for the variety of provisions in place in the EU Member States.

Our model enables us to identify four effects that determine whether one or the other tax system is advantageous: the tax utilization of losses during the considered time frame, the different allocation of the tax base between the Member States under each tax system and the taxation of intragroup interest and dividends. The analysis reveals that for most combinations of profit/loss streams, the CCCTB system proves advantageous. However, the system of SA tends to be advantageous if countries allow to carry losses back and if investments generate time sequences of profits and losses that allow for the utilization of these loss carry-backs. Counter-intuitively – and in contrast to previous studies, the CCCTB system is no longer unconditionally preferable if a cross-border loss-offset is available. Depending on the timing and magnitude of the entities' profits and losses, the benefit from loss carry-backs under SA may exceed the advantage of the cross-border loss-offset under the CCCTB. The model highlights that in some EU countries that do not tax intragroup dividends and allow an unrestricted loss carry-forward the advantageousness of either system is determined by the allocation of the tax base among EU countries only.

Cross-border loss-offset has become an important topic for multinational groups in the European Union (EU) in recent years. In the aftermath of the financial and economic crisis, in many EU countries the amount of incurred losses and loss carry-forwards has increased significantly. Furthermore, in particular, start-ups and R&D investment as examples for innovative activities, which are crucial for MNGs' future performance, often are characterized by initial losses. Under the system of separate accounting (SA) currently applied in Europe, MNGs often are unable to use their losses to decrease their tax payments. Limited cross-border loss-offsets[1] ultimately result in an over-taxation of MNGs (see European Commission 2011, p. 4; Andersson 2007, p. 98, Scheffler 2005, p. 156). The European Commission (2006) stated that "the limited availability of cross-border loss relief is one of the most significant obstacles to cross-border business activity". Thus, the European Commission aims to introduce a common tax base to address those provisions in the European tax systems that limit the growth of companies seeking to benefit from the European single market (see European Commission 2010, p. 18). However, the implementation of the CCCTB is far from clear. In April 2012, the European Parliament adopted a resolution on the CCCTB Directive and proposed certain amendments to the Commission's initial version.[2] In June 2015 the Commission presented an action plan to re-launch the CCCTB project (see European Commission 2015). The debate continues on how to refine the CCCTB system in order to facilitate an agreement between the Member States.

Even though the cross-border loss-offset is one of the main pillars of the proposed CCCTB system, there is little research that compares the proposed CCCTB system and the current system of SA with regard to loss-offset possibilities. The few existing studies presume simplified, stylized national loss-

[1] Only Denmark, Austria and Italy allow under certain conditions consolidated taxation of MNGs (see Schuchter and Kras (2014), p. 13; Ambagtsheer-Pakarinen (2014), p. 13; Gallo (2014), p. 14).

[2] As it is uncertain if and to what extent these proposed amendments will be considered in the course of a potential CCCTB implementation, we disregard them in this analysis.

offset provisions and account – if at all – for a few representative profit/loss scenarios. We expand these studies by accounting for national tax characteristics in detail and by investigating implications about the tax systems in dependence on a vast range of different profit/loss patterns. Moreover, we highlight the impact of a deviating tax treatment of intercompany interest payments and dividends on the advantageousness of both systems.

This article first provides an overview over the most relevant literature (Section 2), followed by an explanation of the legal basis of both tax systems (Section 3). In Section 4, the Franco-German model is introduced. The numerical analysis in Section 5 compares the after-tax outcome for the MNG, given different combinations of profit/loss streams of both group companies between both tax systems. Furthermore, the specific Franco-German model is generalized to account also for other EU Member States. Finally, the main results of the analysis are summarized (Section 6).

2 Prior Literature

Two main streams of research are relevant to our research question. First, prior research examines the impact of loss treatment on investment in either an interstate or cross-border loss-offset situation. Auerbach (1986), Auerbach and Poterba (1987) and Majd and Myers (1987) find that the absence of loss-offset possibilities discourages investment. Against this background, we expect that the design of loss-offset rules also matters for the advantageousness of the CCCTB system and of the system of SA. Both tax systems allow the offsetting of losses, but differ in the design of the rules. Hence, we investigate how specific loss-offset provisions impact the relative attractiveness of the underlying tax systems.

In prior research Barlev and Levy (1975) distinguish between loss carry-forwards and carry-backs, which are both applied under the system of SA in our extended model. In contrast, Donnely and Young (2002) focus on the loss-offset by means of group consolidation as applied under the CCCTB system. By determining the expected value of tax savings in different countries, Barlev and Levy (1975) find that in addition to loss carry-forwards, carry-back provisions are highly valuable and can improve the economic conditions for companies greatly. Donnely and Young (2002) conclude that under group taxation regimes, the tax value of losses is highest. In a study about the Austrian cross-border group taxation regime, Pummerer and Steckel (2005) investigate possible implications of such a system under uncertainty. They conclude that positive effects of the cross-border group taxation regime might be balanced out by disadvantages due to limitations in loss carry-forwards. In our analysis we succeed to further disentangle the effects from cross-border loss-offset and limitations in loss carry-forwards. In line with Donnely and Young (2002), Pummerer and Steckel (2005) and Barlev and Levy (1975), we expect that the cross-border loss-offset and the unlimited loss carry-forward under the CCCTB system and the loss carry-back provisions under the system of SA increase the relative attractiveness of each tax system. However, from their studies we cannot deduce the specific conditions under which one tax system is preferable.

Based on data of German multinationals, Dreßler and Overesch (2013) analyse empirically how the treatment of potential losses impacts multinational investment. In contrast to the analytical study of Barlev and Levy (1975), Dreßler and Overesch (2013) find no statistically significant effects of loss carry-back and, in contrast to Donnely and Young (2002), they find only mixed evidence that group loss-offset provisions foster investment. However, their results suggest that limiting the time frame for loss carry-forwards has detrimental investment effects for companies with a high probability of incurring losses. The limitation of loss carry-forwards, e.g., as applied under SA by the minimum taxation in France and Germany, reduces the attractiveness of SA. While previous studies often disregard detailed loss-offset rules, we integrate them into our model and find loss carry-forward and carry-back, as well as cross-border loss-offsets are significant features of a tax system and a driver as regards whether an MNG is likely to opt for the CCCTB system. We expand the previous studies also by taking account of different profit/loss time patterns. Thus, we are able to draw conclusions about the effects of differently designed loss-offset regimes, depending on different profit/loss-scenarios.

The second literature stream deals with the shift from SA to consolidation and formulary apportionment. As we do not focus on profit-shifting activities under the two systems (like, e.g., Klassen and Shackelford 1998; Goolsbee and Maydew 2000; Mintz and Smart 2004), we refer only to those studies that investigate at least to some extent the differences in loss-offset possibilities. Using a model-theory approach, Gérard and Weiner (2003) compare the impact of cross-border loss-offset and consolidation under a system of consolidation and formulary apportionment and under a system of SA for the investment behaviour of an MNG. They assume that under SA, no loss-offset or a cross-border loss-offset is applied. Thus, contrary to our approach, they do not include the possibility of a separate per country loss-offset, which is currently common in EU Member States. They show that cross-border loss-offsets mitigate the reactions to tax changes, whereas consolidation and formulary apportionment boosts the sensitivity thereto.

Using a numerical analysis, Dahle and Bäumer (2009) compare the effects of selected loss-offset limitations under SA with those under the CCCTB system and the European tax allocation system for MNGs' cross-border investment. While we consider different profit/loss time frames and also include in our investigation currently applied EU loss-offset rules, they restrict their analysis to selected increasing/constant cash-flow streams. They conclude that the replacement of SA by the CCCTB system would generally increase profitability due to cross-border loss-offsets.[3] By contrast, in this article we find mixed results and clarify that the CCCTB system – even in loss scenarios – may not be beneficial. Oestreicher, Keser and Kimpel (2013) study loss-making corporate groups and their decision regard-

[3] For more literature regarding asymmetric taxation in an international setting that does not specifically refer to the CCCTB, see Lyon and Silverstein (1995) and Niemann (2004a).

ing whether to opt for the CCCTB system. In contrast to the present article, they shed light on the decision-making process from a behavioural perspective. Their experiment with human subjects indicates that loss-exposed groups tend to opt for the CCCTB system. Their results are mostly in line with the outcomes of our model.

To our knowledge, there is, as yet, no analytical investigation that compares SA and CCCTB with regard to loss-offset rules and different profit/loss time frames. This is surprising, given that prior research indicates that both loss-offset rules and cash flow time structures are crucial for investment decisions. In this article, we aim to fill this void. As the lack of cross-border loss-offset under SA is "one of the most important obstacles to cross-border economic activity" (European Commission 2001, p. 39), loss-offset rules under a CCCTB system may be a promising avenue to improve the environment for cross-border investment. We identify conditions for such an improvement for MNGs. Our results allow investors to anticipate the tax effects in loss scenarios, and also allow tax reformers to improve their estimation of the expected behaviour of MNGs on CCCTB enforcement. These results are particularly noteworthy in the aftermath of economic crises, which are likely to generate huge amounts of loss carry-forwards. Thus, our findings may contribute to national and European tax reform discussions.

3 Legal Basis

3.1 CCCTB

Here, we assume that the CCCTB system will come into force as proposed in the draft of the Directive (see European Commission 2011). The main purpose of the CCCTB project is to enable the consolidated computation of taxable income for corporations operating within the EU (see Barenfeld 2007, p. 259). Thus, losses incurred by one taxpayer are automatically offset against profits of other group entities (see Temme, Sporken and Okten 2011, p. 323). The consolidation eliminates intragroup transactions, such as transfer pricing transactions and interest and dividend payments (article 59). The consolidated tax base is subsequently reallocated to the group members by using a formula-based sharing mechanism (see European Commission 2011, p. 8 (iii)). The formula takes into account three equally weighted factors, namely sales, labour and assets. The CCCTB system does not imply a harmonized tax rate. The Member States still have the right to tax their share of the tax base at their national corporate tax rate (article 103). MNGs are allowed to carry forward losses indefinitely and without limitation as to the amount (article 43), whereas a loss carry-back is not allowed at all. EU resident companies and non-EU resident companies with permanent establishments or subsidiaries in the EU may opt for the CCCTB system (see Piot, Sigurdardottir and Rasch 2011, p. 415). In cases where only EU companies are involved, MNGs that wish to opt for the CCCTB must use a special form (listed in Annex 1) and are subject to the corporate taxation system of the respective countries (listed in Annex 2, article 2). The system is based on an "all-in, all-out" approach (article 55 c)), that is, companies which belong to the same group may not opt for the CCCTB system separately, but only jointly with other group members (see Temme, Sporken and Okten 2011, p. 324). Once a company has opted into the system for the first time, it must apply the CCCTB system for at least five consecutive tax years (article 105 (1)).

3.2 Germany and France

In the course of France and Germany's efforts to establish a mutual CCCTB, Germany and France matched their loss-offset provisions. Thus, the loss carry-forward and carry-back provisions are now almost identical in both countries. Losses that are not carried back "may only be carried forward to be set off against the first € 1 million of net income in a given year without restriction" (Perdelwitz 2014, p. 9) in both countries (see also Gaoua 2014, p. 11). The remaining loss carry-forward can only be offset against up to 60% in Germany and up to 50% in France of the net income exceeding € 1 million. There is no time limitation for loss carry-forwards in both countries. Corporate taxpayers are also allowed to carry losses back amounting up to € 1 million for one year in both countries (see Gaoua 2014, p. 11; Perdelwitz 2014, p. 9). The loss carry-back entitles a French taxpayer to a tax credit. "The tax credit may be used during the following [five] years, and will be refundable in the sixth year" (Gaoua 2014, p. 11). In Germany, the loss carry-back is directly offset against the net income of the previous year and leads to an immediate tax refund. Furthermore, neither France nor Germany currently allows cross-border loss-offsets.

The effects resulting from dividend taxation are crucial for the following analysis, as well. The dividends that the German parent receives from the French subsidiary are tax-exempt, with a lump sum of 5% of the gross dividend considered as a non-deductible expense (see Perdelwitz 2014, p. 13). France levies withholding taxes neither on these dividends in line with the Parent-Subsidiary Directive nor on interest payments (see Gaoua 2014, p. 23). Moreover, interest payments are fully deductible from the tax base under both national tax codes (see Perdelwitz 2014, p. 7; Gaoua 2014, p. 8) insofar as thin capitalization rules do not apply .[4] In addition to the classic corporate tax, companies in Germany and France are also subject to a local business tax and a surcharge. The different kinds of taxes are taken into account in our model by the applied tax rate.[5] The two tax systems explained above are used in our extended model in Section 4.3

4 Model

In the following, we introduce a model taking into account the most noteworthy loss-related character-

[4] For the considered numerical examples, the safe harbour rule applies for the deductibility of interest in France.

[5] Also Kiesewetter and Mugler (2006) take the local business tax into account via the applied tax rates. As the German local business tax is of key significance for the taxation of corporations, its treatment is also crucial under the CCCTB system. However, so far it has failed to resolve whether and, if so, how the German local business tax would be integrated into the CCCTB system (see Scheffler et al. 2013, p. 28.). We assume that the local business tax is applied under the CCCTB system as applied under the German tax code. Consequently, we apply the same statutory profit tax rate for Germany under both systems.

istics of both tax systems. We assume that the parent company is based in Germany and its wholly-owned subsidiary in France. Both companies are fully equity-financed and have invested in a national real investment project that generates cash flows and gives rise to depreciation. During the period under review, this project is taken as the companies' only business activity. The French subsidiary distributes all profits, in the form of dividends, to its German parent at the end of each year.[6] By assumption, the German company uses these funds either to invest in the capital market or to redeem a loan. It carries out the capital market investments in Germany, since the German after-tax interest rate is the higher one (see Niemann and Treisch 2006, p. 1020; Gérard and Princen 2012, p. 10).[7]

To focus on the effects of the respective tax systems, we assume in the basic scenario that the companies do not adjust their investment behaviour (e.g. reallocate their assets or workforce) in order to achieve a more tax-efficient situation through formulary apportionment under the CCCTB system[8] and that companies do not engage in profit shifting via transfer pricing under the system of SA. We take the behaviour of taxpayers as given and focus instead on inherent differences in the two alternate tax regimes. As we think the MNGs' efforts to optimize the tax structure are nearly similar under both systems our results should not be biased towards one system if we abstract from behavioural adaptations. Kiesewetter et al. (2014) support our view. They find that the implementation of the CCCTB would not aggravate to shift profits for MNGs. They argue that formula apportionment simply offers new methods for tax planning. Instead of shifting profits via transfer pricing, MNGs manipulate book values of assets. Furthermore, Nielsen et al. (2003) find that under imperfect competition MNGs under both tax systems would use the same tax optimization channel– namely transfer pricing – in order to reduce the tax burden. Under formulary apportionment transfer pricing is used to manipulate the sales factor of the group entities.

Furthermore, we neglect compliance costs (see Bettendorf et al. 2010, p. 577; Devereux and Loretz 2008, p.3) and abstract from shareholder taxation. Given heterogeneous shareholders with different tax brackets, investment decisions in MNGs are typically made without reference to shareholder-level taxation (see Cooper and Knittel 2010, p. 52; Egger and Loretz 2010, p. 1025; Niemann and Treisch 2006, p. 1016; Oestreicher and Koch 2011, p. 70). By simplifying our analysis in this way, the impact of the different loss-offset mechanisms under the two tax systems can be highlighted. Annual depreciation of the underlying asset is assumed to be straight-line and identical under both systems.[9] Furthermore, we assume that neither France nor Germany levies a different corporate tax rate under the

[6] A yearly dividend distribution is also assumed by Gérard and Princen (2012), p. 5.
[7] Taking into account the statutory profit tax rates in France (38.93%) and Germany (30.95%), the interest rate and the dividend taxation, Germany turns out to be the country of choice for financial investments.
[8] Also Devereux and Loretz (2008), p. 2; Oestreicher and Koch (2011), p. 92 abstract from behavioural changes of firms.
[9] We interpret depreciations under both tax systems as a proxy for all other kinds of non-cash accruals. See, e.g., Niemann (2004b), p. 362, and Dahle and Bäumer (2009), p. 8.

CCCTB system than under their domestic systems.[10] By assumption, the group fulfils all eligibility requirements for the CCCTB system.[11] We also assume a perfect capital market with a pre-tax debit interest rate for borrowing identical to the pre-tax credit interest rate (see Dahle 2011, p. 61). The pre-tax interest rates in France and Germany are assumed to be identical. We take the after-tax net cash flow as a criterion for identifying tax effects.

We describe in the following exemplarily the calculation of the MNGs' net cash flows in only one period and, on this basis, demonstrate the determination of cash flows and tax payments in all periods of the time frame under review.

4.1 Separate accounting

The MNG maximizes its after-tax net cash flows. The net cash flow NCF_t^{SA} of the MNG in period t under the system of SA is determined by summing up the gross cash flows CF_t^{GER}, CF_t^{FR} and the interest income (pre-tax interest rate i_t times the financial investment of the previous period $FI_{t-1}^{SA_{GER}}, FI_{t-1}^{SA_{FR}}$[12]) and subtracting the tax payments $TP_t^{SA_{GER}}, TP_t^{SA_{FR}}$[13] of both group companies:

$$NCF_t^{SA} = CF_t^{GER} + CF_t^{FR} + i_t * FI_{t-1}^{SA_{GER}} + i_t * FI_{t-1}^{SA_{FR}} - TP_t^{SA_{GER}} - TP_t^{SA_{FR}}. \quad (1)$$

If the French company incurs a positive net cash flow $NCF_t^{SA_{FR}}$ it distributes a dividend to the German company. Under the principle of prudence, the dividend distribution is limited to the net cash flow less depreciation (see Meller 2010, p. 148). Given that the distribution limitation applies, surplus liquidity amounting to the value of the depreciation is retained in the French company. The French company is assumed to reinvest this excess liquidity in the French capital market. Whenever the French company incurs losses, we assume that it takes out a loan from the German company. Although the French company is fully equity-financed, we assume that all of its means are bound in assets or projects and thus are not available to compensate for the loss. The bound means are assumed to be sufficient to serve as collateral for loans taken from the parent company. Due to the positive pre-tax present value of earnings it is assured that the entities only temporarily incur losses in our setting. Thus, the subsidiary is at no point in time exposed to insolvency risk. The French company is assumed to redeem 10% of the principal amount P_t^{FR} in the following period.[14] Furthermore, it pays interest at the market rate

[10] Also, Oestreicher and Koch (2011); Fuest et al. (2007) and Devereux and Loretz (2008) assume for their empirical studies the same tax rate under the CCCTB systems.

[11] We refer here in particular to the two-part test that determines the membership of a company in a group by control and ownership (article 54).

[12] If variables used for building the relevant models do not have the same values under both systems, the variables are additionally labelled with "SA" or "CCCTB", respectively.

[13] The formulas are based on the approach of Schanz and Schanz (2011), pp. 275-293, and adjusted for CCCTB and separate accounting purposes in our setting.

[14] Even if 100% were redeemed in the second period, our results only change in a few border cases. The interest and dividend taxation effects prove to have a rather small impact on our results. We do not account for the future effects resulting from the redemption of the remaining principal amount explicitly since it would increase the complexity of the model tremendously. Exemplary conducted numerical simulations support this approach

to the German parent. If the company redeems the principal amount of the loan, the dividend in eq. (2) is determined following deduction of this payment. If the German parent is short on funds, it borrows from the capital market to fill the gap. Finally, the fraction of the French net cash flow that exceeds the value of the depreciation and the redemption of the principal amount is distributed to the German parent company as a dividend DIV_t. The German parent company invests all of its surplus liquidity in the German capital market (see Bäumer 2011, p. 72; Sureth and Bäumer 2010, pp. 176-179).

$$DIV_t = max\left\{CF_t^{FR} + i_t * FI_{t-1}^{SA_{FR}} - TP_t^{SA_{FR}} - D_t^{FR} - 0.1 * P_t^{FR}; 0\right\}. \tag{2}$$

We obtain the tax payments TP_t^{SA} to be made by each company by multiplying the tax rate τ_t by the tax base TB_t^{SA}. In both countries, the tax base TB_t^{SA} is determined by the adjusted gross income AGI_t^{SA}, the loss-offset LO_t^{SA} and the loss carry-back LCB_t.[15]

$$TB_t^{SA} = \max\{AGI_t^{SA} - LO_t^{SA}; 0\} - LCB_t \ . \tag{3}$$

Apart from the addition of 5% of the gross dividend under German law, the adjusted gross income AGI_t^{SA} is similarly determined in both countries:

$$AGI_t^{SA_{FR}} = CF_t^{FR} - D_t^{FR} + i_t * FI_{t-1}^{SA_{FR}}, \tag{4}$$

$$AGI_t^{SA_{GER}} = CF_t^{GER} - D_t^{GER} + i_t * FI_{t-1}^{SA_{GER}} + 0.05 * DIV_t. \tag{5}$$

Eq. (6) reflects the determination of the loss-offset for the German company. The equation for the French company is similar, except that 0.5 (instead of 0.6) of the € 1 million exceeding amount of the net income may be utilized to offset losses.

$$LO_t^{SA_{GER}} = min\left\{LCF_{t-1}^{SA_{GER}}; max\left\{AGI_t^{SA_{GER}}; 0\right\}; 1{,}000{,}000 + 0.6\left[max\left\{AGI_t^{SA_{GER}}; 0\right\} - 1{,}000{,}000\right]\right\}. \tag{6}$$

The loss carry-forward LCF_t at the end of period t, that can be utilized in period $t+1$, can be derived from the following equation for the German and the French company:

$$LCF_t^{SA} = LCF_{t-1}^{SA} - min\{0; AGI_t^{SA}\} - LCB_t - LO_t^{SA}. \tag{7}$$

France and Germany allow for an annual loss carry-back LCB_t up to € 1 million:

$$LCB_t = \min\left\{1{,}000{,}000; \max\left\{\mathrm{TB}_{t-1}^{SA}; 0\right\}; \max\left\{-\mathrm{AGI}_t^{SA}; 0\right\}\right\}, \tag{8}$$

As the German company receives all profits from the French company in form of dividends or compensates losses that incur in the French company, the financial investment $FI_t^{SA_{GER}}$ of the German company in period t is equal to the MNG's net cash flow NCF_t^{SA} and the financial investment $FI_t^{SA_{FR}}$ of the French company is equal to zero. Just in case the French company incurs profits

as they indicate that the present value of these effects is negligible small.

[15] As eq. 3 is valid for both the French company and the German company, we decided not to label the variables with the country-specific abbreviations.

$(CF_t^{FR} + i_t * FI_{t-1}^{SA_{FR}} - TP_t^{SA_{FR}})$ that are higher than the depreciation D_t^{FR}, the financial investment $FI_t^{SA_{GER}}$ of the German company amounts – due to the former mentioned principal of prudence – to $NCF_t^{SA} - D_t^{FR}$ and the financial investment $FI_t^{SA_{FR}}$ of the French company is equal to D_t^{FR}.

The model defined in this subsection depicts the main legal characteristics of the national French and German tax law that we take into account for our analysis.

4.2. CCCTB

Similar to the system of SA, net cash flow under the CCCTB system is determined as follows:

$$NCF_t^{CCCTB} = CF_t^{GER} + CF_t^{FR} + i_t * FI_{t-1}^{CCCTB_{GER}} + i_t * FI_{t-1}^{CCCTB_{FR}} - TP_t^{CCCTB_{GER}} - TP_t^{CCCTB_{FR}}. \quad (9)$$

The taxes to be paid under the CCCTB system result from the application of the German and French tax rate to the respective shares of the group tax base. The apportionment factor β denotes the share of the group tax base that is allocated to the German company. Thus, $(1 - \beta)$ of the tax base is allocated to the French company.

$$TP_t^{CCCTB} = TP_t^{CCCTB_{GER}} + TP_t^{CCCTB_{FR}} = (\beta * \tau_t^{GER} + (1 - \beta) * \tau_t^{FR}) * TB_t^{CCCTB}, \quad (10)$$

where $0 \leq \beta \leq 1$.

The tax base under the CCCTB system TB_t^{CCCTB} consists of the adjusted gross income AGI_t^{CCCTB}, insofar as it is positive, minus a potential loss-offset LO_t^{CCCTB} at the group level. If the sum of the adjusted gross incomes is negative, the tax base will take on a value of zero.

$$TB_t^{CCCTB} = \max\{AGI_t^{CCCTB}; 0\} - LO_t^{CCCTB}, \quad (11)$$

with the adjusted gross income AGI_t^{CCCTB}:

$$AGI_t^{CCCTB} = CF_t^{GER} - D_t^{GER} + i_t * FI_{t-1}^{CCCTB_{GER}} + CF_t^{FR} - D_t^{FR} + i_t * FI_{t-1}^{CCCTB_{FR}}. \quad (12)$$

The amount to be offset under the CCCTB system is restricted by the lesser of two terms: the adjusted gross income and the loss carry-forward accumulated in the previous periods. As a minimum taxation provision is not implemented, we obtain for the loss-offset LO_t^{CCCTB}:

$$LO_t^{CCCTB} = \min\left\{LCF_{t-1}^{CCCTB}; max\{AGI_t^{CCCTB}; 0\}\right\}. \quad (13)$$

The loss carry-forward LCF_t^{CCCTB} under the CCCTB system is determined in the same way as under the system of SA, except that no loss carry-back needs to be considered:

$$LCF_t^{CCCTB} = LCF_{t-1}^{CCCTB} - min\{0; AGI_t^{CCCTB}\} - LO_t^{CCCTB}. \quad (14)$$

Note that the former mentioned principle of prudence is purely an accounting principle that applies under the CCCTB system as well. Thus, the financial investments per country $FI_t^{CCCTB_{GER}}$ and $FI_t^{CCCTB_{FR}}$ in period t are determined analogously to the financial investment per country under the system of SA. If the profits of the French company ($CF_t^{FR} + i_t * FI_{t-1}^{CCCTB_{FR}} - TP_t^{CCCTB_{FR}}$) are higher than the depreciation D_t^{FR}, the German financial investment $FI_t^{CCCTB_{GER}}$ is equal to NCF_t^{CCCTB}- D_t^{FR} and the French one $FI_t^{CCCTB_{FR}}$ equals D_t^{FR}. If the French profits are not higher than D_t^{FR}, the German financial investment $FI_t^{CCCTB_{GER}}$ is equal to the MNG's net cash flow NCF_t^{CCCTB} and the French one $FI_t^{CCCTB_{FR}}$ is equal to zero.

Based on the models for the system of SA and the CCCTB system, we built up the financial plans for the numerical analysis.

5 Numerical Analysis

Providing a detailed picture of the loss-offset rules under either system in a closed-form, multi-period, theoretical model is difficult, as non-linear functions and condition-based provisions must be taken into consideration. Even in short-period perspectives, analytical models become inscrutable and scarcely allow any generalizable economic conclusions. As a result, we are forced to fall back on financial plans with numerical examples to capture specific conditions from the analysis.[16] Financial plans allow us to deal with complex rules also in multi-period settings. In the numerical analysis, we calculate the after-tax future value (see Sureth, Mehrmann and Dahle 2010, p. 168) of the underlying investment of the MNG by summing up the compounded net cash flows of each period under consideration.

5.1 Scope of the numerical analysis

By considering a continuous period, the values of the previously introduced variables[17] are functions of the cash flows CF_t^{GER}, CF_t^{FR} and the depreciation D_t^{GER}, D_t^{FR} from the current or prior periods and the exogenous variables, i.e. i, τ^{FR}, τ^{GER}.[18] Consequently, the decision to opt for the CCCTB system ultimately depends only on the cash flow time pattern[19] of the French and the German companies, the corresponding depreciation and the exogenous variables. The following analysis focuses on the impact of different combinations of time patterns and magnitudes of cash flows and depreciation on the relative advantageousness of either tax system. By assumption, the decision as to whether to opt for the CCCTB system must be made at the beginning of the first period.

To demonstrate the tax effects, we consider pre-tax cash flows for both the German and the French company that vary in increments of € 200,000 between -€ 3 million and € 3 million in the first period.

[16] This approach is in line with Majd and Myers (1987); Haegert and Kramm (1977); Niemann (2004b).

[17] These are the adjusted gross incomes, the tax bases, the loss carry-forwards, the loss carry-backs, the loss-offsets, the dividend payments and the financial investments.

[18] The apportionment factor β consists partly of a fixed component (allocation of assets and labour) and partly also on the cash flows as a proxy for the sales of the respective company. See Section 5.2.1.

[19] Earlier analyses have already shown that cash flow time patterns are important for potential loss-offsets. See Barlev and Levy (1975), p. 178; Haegert and Kramm (1977), p. 205; Niemann (2004a), p. 24; Niemann (2004b), p. 363; Dahle (2011), p. 62.

This range of values is sufficient to illustrate which cash flow pattern is advantageous for which tax system. To analyse the effect of different loss-offset rules, both the French company and the German company are required to have at least one tax year with losses. In order to ensure this and, furthermore, to ensure that the alternative time patterns and magnitudes of the pre-tax cash flows are still comparable, we assume that the pre-tax present value of the cash flows of each company is always € 100,000.[20] Thus, a specific growth factor ε must be applied to the first period's cash flows to determine the cash flows for the subsequent period. This factor is calculated as follows:

$$\varepsilon = \frac{100{,}000 - CF_1}{CF_1 * (1+i)^{-1}}. \tag{15}$$

Using eq. (15) leads to a high positive cash flow in the first period and a high negative cash flow in the second period, and vice versa, for each company. This determination of the cash flows in both periods guarantees that a change in the ranking of the alternative tax systems is impacted only by the different taxation procedures.

Nevertheless, the determination of positive and negative pre-tax cash flows is not sufficient to ensure that a tax loss or profit arises, as the tax base depends also on the interest payments/income, on depreciation allowances and, in addition, on 5% of the gross dividend under the system of SA. However, the values of the crucial variables are chosen in the numerical analysis in such a way that both companies always face one profit period and one loss period under both systems. The depreciation D, amounting to € 30,000 for both companies $D_t^{GER} = D_t^{FR} = D$, is chosen in such a way that the French and German investment projects are worthwhile after taxes.[21] We use effective statutory profit tax rates for Germany and France of 30.95% and 38.93%, respectively, as computed by the Centre for European Economic Research (see Spengel et al. 2014). Furthermore, a pre-tax debit and credit interest rate of 2% is assumed.[22]

We assume that remaining loss carry-forwards at the end of the second period may be offset against profits of other future investment projects (see Oestreicher and Koch 2011, p. 80). Using a two peri-

[20] Assuming equal after-tax present values of the cash flows of both companies under one tax system, and taking this case as a benchmark for the analysis of the respective other tax system, would not reveal the inherent differences between Germany and France in the former tax system and is thus inappropriate for our analysis.

[21] Whether or not an investment project is profitable depends in part on the size of the initial investment, which we do not refer to here explicitly. However, we assume that the initial investment is equal to the sum of the depreciation allowances over the useful life of the underlying asset. We choose the depreciations such that the net profit margins for both companies are in line with commonly observable market margins. In case of very smooth earnings of both companies ($CF^{Ger} = CF^{Ger} = 0$) the overall tax payments are lowest under both systems and thus the average net profit margins are highest after the assumed two periods. In this high-profit case the net profit margin amounts to around 25%. This margin is in line with the net profit margins that are common in the most profitable industries in 2014 (see Sageworks 2014).

[22] The effective interest rates for lending and borrowing published by the German Federal Bank (Deutsche Bundesbank) are close to 2% for corporate entities for a time horizon of two years: interest rate for lending amounts to 2.22% (German Federal Bank, 2015b) and for borrowing amounts to 2.43% (German Federal Bank 2015a), both for for June 2015.

ods-model allows us to capture the decisive characteristics of both tax systems and simultaneously to single out the loss induced implications. The main differences in the utilization of losses between the two systems already arise in the first two periods since the group can make use of the loss carry-back under SA while not under CCCTB. Although in the following periods the group may use remaining loss carry-forwards under SA, however, the overall tax benefit from loss-offset under the CCCTB system is greater. Thus, and in order to keep the analysis as simple as possible, it is adequate to estimate the future tax effects from loss carry-forwards. Empirical evidence suggests that the remaining loss carry-forwards of both companies can be valued at $\theta^{SA} = 40\%$ of their face value under the system of SA.[23] As the possibilities to offset losses tend to be better under the CCCTB system, we assume that $\theta^{CCCTB} = 45\%$ of the loss carry-forwards may be utilized.[24] We test the robustness of our result with respect to these values in the sensitivity analysis.

5.2 After-tax future values

The following two figures illustrate how the MNG's after-tax future values under the CCCTB system and under the system of SA, respectively, depend on the "earnings". For the purpose of this paper, "earnings" denotes "cash flows CF less depreciation D" of the German and French company. Here, we refer to the after-tax future values as relative decision criteria since they allow us to compare the decisions effects of the respective tax systems directly. The values for the German and French earnings are plotted in increments of € 200,000. However, we consider that two periods, the abscissa and the ordinate are scales with regard to "cash flows less depreciation in the first period". As the cash flows of the second period are endogenously determined by the growth factor ε, the corresponding earnings for the second period do not have to be plotted explicitly. The disparity in the future values is, under both tax systems, mainly driven by the utilization of losses. The more that losses may be utilized during the time frame under consideration, the higher the after-tax future values.

5.2.1 CCCTB system

The group tax base under the CCCTB system is allocated to the French company and the German company according to the apportionment formula. We assume that the formula factors of assets and labour are equally allocated between both companies, so that 50% of these factors are attributed to

[23] Empirical evidence indicates that approximately 40% of German losses may later be offset against profits. See Schneider (1988), p. 1222; see also Niemann and Treisch (2006), p. 1020; Haegert and Kramm (1977), p. 205. Furthermore, a more recent study by Kager, Schanz and Niemann (2011) supports our assumption. Using information from a questionnaire sent to German DAX30 companies they find evidence that the share of utilizable losses is substantially lower than the total stock of tax losses. We refer to their results and calculate the average of the ratios of the estimated amount of useable losses divided by estimated total stock of tax losses for the companies listed in Table 8, p. 116, of their study. The average share of utilizable losses amounts to 41%. Note, we dropped companies with missing variables. As the German and the French provisions for loss carry-forwards are almost similar, we assume that this evaluation holds for the French company as well.

[24] Due to the cross-border loss-offset and the non-existence of the minimum and dividend taxation, the possibilities to offset losses might be better under the CCCTB system. That implies that losses tend to get offset earlier under the CCCTB system (timing effect) and that there is an increased likelihood for a complete loss-offset in a reasonable time.

each company in both periods.[25] The accumulation of financial assets in Germany does not change the asset allocation between both companies, as financial assets are disregarded for determining the asset factor. The sales factor for each company is assumed to vary in line with the respective pre-tax cash flows. We take the magnitude of the pre-tax cash flows as a proxy for the magnitude of the sales of every company.[26] If the pre-tax cash flow is negative for one company, we assume that this company does not engage in any sales, so that 100% of the sales are generated by the other company. In that extreme case, the group tax base is apportioned to the companies in the proportion of 33% to 67%.[27] For varying French and German earnings we obtain the future earnings that are illustrated in Fig. 1.

The highest future values (approximately € 175,000) emerge for that half of the combinations of French and German earnings that result in a negative or zero CCCTB in the first period (combinations of area 1).[28] For the other half of the combinations (combinations of area 2), that lead to a positive CCCTB in the first period, the future values decrease with increasing French and German earnings. When the German and French earnings take the maximum considered value of approximately € 3 million, the lowest future value of -€ 985,679 occurs.

A negative or zero CCCTB in the first period (area 1) leads to the highest future values, as all losses can be utilized to decrease the tax burden in the second period. Thus, area 1 represents full loss-offset scenarios. The loss carry-forward of the first period may be utilized to offset a large share of the taxable profits of the second period. By contrast, a positive CCCTB in the first period (area 2) leads to lower future values, as the resulting losses of the second period may not be utilized during the time interval considered. Taxes must be paid on the profits of the first period, whereas the losses of the second period are evaluated at only θ^{CCCTB} = 45% to offset future profits. By increasing first period's earnings of a group company, the relative gap between taxes paid in the first period and the assigned present value of the future tax refunds for the loss carry-forwards of the second period increases, as

25 As both group companies incur the same present value of pre-tax cash flows, we presume that both companies invested the same amount of money in their respective projects. Assuming that the investment involves the same level of labour and assets in both countries, 50% of these factors are allocated to each company. As liquid funds are invested in the capital market and not in real investment projects of the companies, we further assume that no additional assets are purchased and no additional workforce is hired in the period under review. Vice versa, we assume that the companies do not sell part of their assets or reduce workforce in loss-making periods. Thus, the magnitude of assets and labour is assumed to remain constant. Also Eberhartinger and Petutschnig (2014) assume in their game-theoretic analysis that assets are distributed equally between their two considered countries. For a detailed examination of potential effects of real investments on apportionment factors see Dietrich and Kiesewetter (2007), p. 507.

26 The share of the sales factor, which is allocated to each company, is approximated by the relation of the pre-tax cash flows of the respective company to the pre-tax cash flows of the group. We assume that the German company sells to German clients, and the French company to French clients. The companies are assumed to not export to other countries.

27 In an alternative approach, we assume that the apportionment factor β is fixed and constant over time and thus it is independent of the magnitude of the pre-tax cash flows. Untabulated results show that this variation has little impact on our results even if the apportionment factor β takes on extreme values of zero or one.

28 This is the case if the absolute value of negative earnings of one company is greater than or equal to the positive earnings of the other company, or both group companies incur negative or zero earnings in the first period.

well. Thus, by increasing earnings in the first period, more taxes must be paid in relation to the pre-tax cash flows of € 100,000, what results in lower future values for the group.

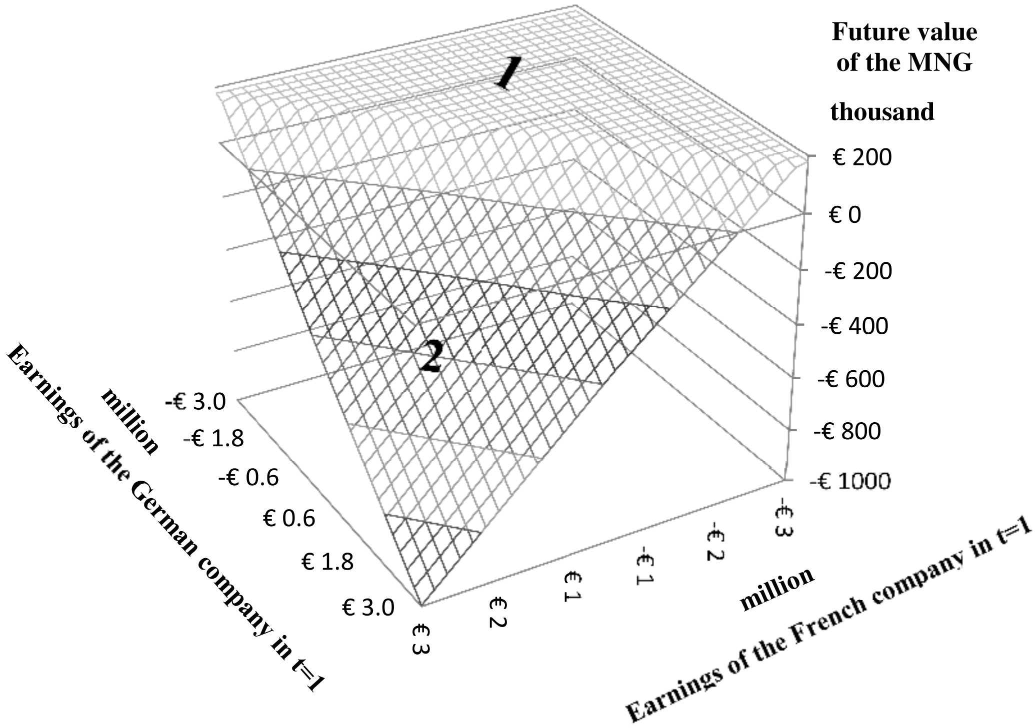


Fig. 1 Future values under the CCCTB system

5.2.2. System of separate accounting

In Fig. 2 we show the MNG's future values under the system of SA. Due to the application of SA in determining the tax burden of the group companies, and due to increased complexity with regard to the treatment of losses, this graph is more complex than that in Fig. 1. All losses may be utilized for tax purposes if neither the loss carry-back restriction nor the minimum taxation applies for the companies. This is the case if the earnings of both group companies range between - € 1.2 million and € 1 million in the first period (area A in Fig. 2). Thus, area A represents scenarios with full loss utilization. In area A, future values are not identical but only differ slightly. The highest future value under the system of SA amounts to € 173,789.

If the earnings of the German and/or French group company exceeds € 1 million in the first period, the loss carry-back restriction will apply in the second period. The minimum taxation applies in the second period, given that the earnings of the respective group companies fall below -€ 1.2 million in the first period. The future values decrease with increasing/decreasing earnings of the group companies in the first period if the earnings exceed the respective limits for the loss carry-back restriction and/or the minimum taxation. The more the earnings exceed these limits, the smaller the share of the overall losses that may be utilized during the given time frame and the smaller the resulting future values.

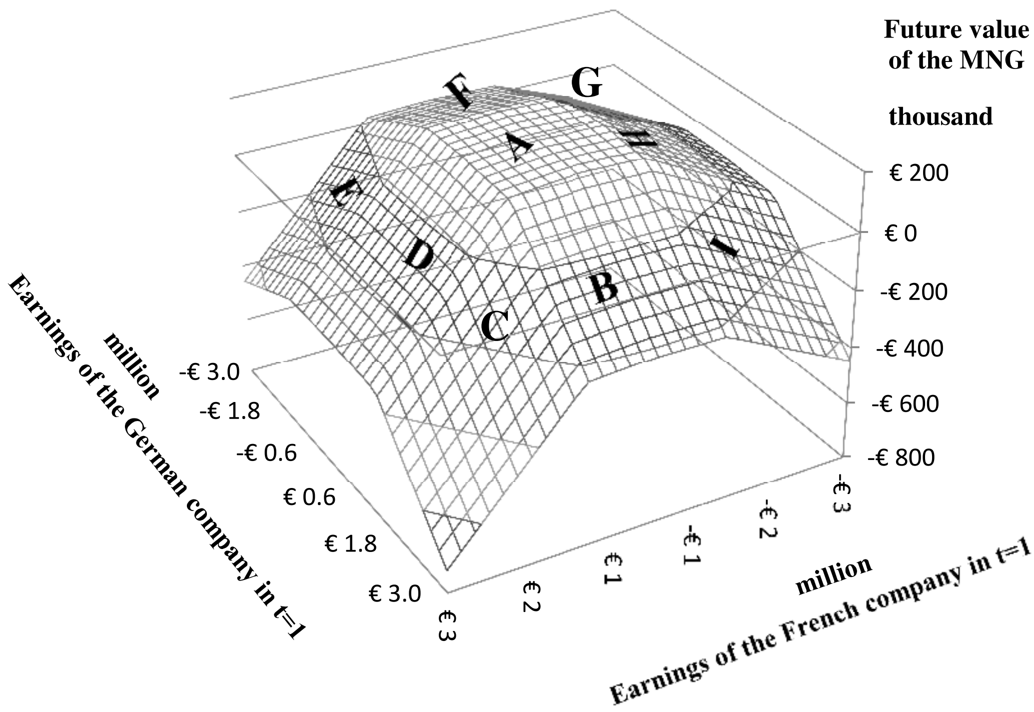


Fig. 2 Future values under the system of separate accounting

As long as only one of the two group companies may not entirely utilize its losses in the given time frame but the respective other company may do so, the future values of the group range between areas B (loss carry-back restriction applies to the German company), D (loss carry-back restriction applies to the French company), F (minimum taxation applies to the German company) or H (minimum taxation applies to the French company). If both of the group companies may not entirely utilize their losses, the future value lies in areas C (loss carry-back restriction applies to both companies), E (minimum taxation applies to the German company and the loss carry-back restriction applies to the French company), G (minimum taxation applies to both companies) or I (loss carry-back restriction applies to the German company and minimum taxation applies to the French company). The lowest future value (-€ 696,755) of the group arises if the earnings of both group entities take the highest values considered in this analysis (i.e. approximately € 3 million), as then due to the loss carry-back restriction the largest share of losses remains unused.

We find that the time pattern of the profits/losses streams and, arising from this, the divergent opportunities to utilize the upcoming losses are the key drivers of the MNG's future values under both tax systems in our setting.

5.3 Favourable tax system depending on time structure and magnitude of earnings

The following graph illustrates which of the two underlying tax systems is advantageous for which combinations of earnings of the French company and the German company, based on the future values shown in the previous two graphs (Fig. 1 and 2).

As the graph in Fig. 3 shows, the CCCTB system is advantageous for most of the plotted earnings. The graph shows 961 combinations, and for 622 of them the CCCTB system is preferable. However, the system of SA is advantageous if the German and French earnings are positive in the first period or if they are slightly negative for one group entity and positive for the other.

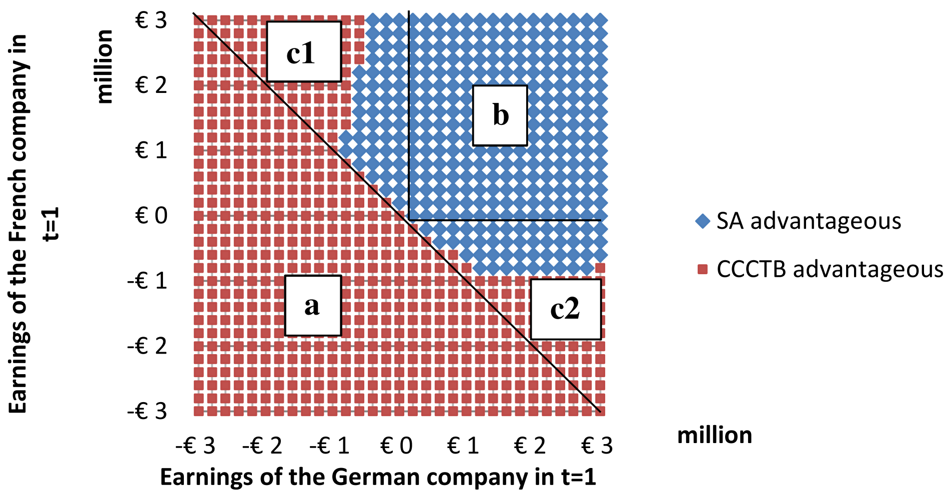


Fig. 3 SA vs. CCCTB depending on earnings of both companies

Depending on different time patterns of the entities' earnings we identify four different tax effects that are crucial for the relative attractiveness of either system. The magnitude of each of these four effects determines whether the one or the other tax system is overall preferable:

- *loss utilization effect*: This effect refers to the share of overall group losses that may be offset against profits under each tax system. The evaluation of the remaining loss carry-forwards at the end of the second period is also decisive for the advantageousness of each tax system;
- *dividend taxation effect*: This effect is always to the disadvantage of the system of SA, as 5% of the intragroup dividends constitute a non-deductible expense for the German company. To check whether our results hold for fully tax-exempt dividends[29] on the parent level, we conducted a sensitivity analysis and found in tendency corresponding results. [30]
- *interest taxation effect*: Given that the French subsidiary must take a loan from the German parent, the interest payments in subsequent years are deductible in higher-taxed France and are taxed in the lower-taxed Germany under the system of SA. Intragroup loans are irrelevant for tax purposes under the CCCTB system. Thus, in this setting, the interest taxation effect always favours the system of SA;[31]

[29] Only in France, Germany, Italy and Belgium 5% of the gross dividend is subject to tax.

[30] Only in some exceptional cases our results change.

[31] The interest taxation effect occurs only if the French subsidiary incurs losses in the first period and thus takes a loan in the first period. Consequently, it pays interest in the second period.

- *tax base allocation effect*: The shares of the overall group tax base that are taxed in France/Germany under the CCCTB system differ from the shares that are taxed under the system of SA.[32]

Generally speaking, the tax base allocation between the two companies tends to be more moderate under the CCCTB system than under the system of SA, due to consolidation and due to the equally-allocated formula factors of assets and labour. As the French tax rate is higher than that in Germany ($\tau_t^{GER} < \tau_t^{FR}$), it is desirable from the group's perspective that most profits be taxed in Germany and most losses in France. However, as every company generates profits in one period and incurs losses in the other, the tax system that proves to be advantageous with regard to the tax base allocation in one period becomes disadvantageous in the other period. Thus, the tax base effects counterbalance each other to some extent during the periods under review. However, due to the positive present value of the pre-tax cash flows and due to the partly extinguished losses at the end of the second period, the impact of the tax base allocation in the profit period is stronger than that of the loss period.

For the following interpretation, we first consider the combinations of earnings that result in a negative or zero CCCTB in the first period (combinations of area a, area a also includes also the diagonal line of the graph). A full utilization of losses may be achieved for all combinations of area a under the CCCTB system,[33] but for only a few combinations under the system of SA, due to the loss carry-back restriction and the minimum taxation. Even in cases in which losses may be offset entirely under both systems, the dividend taxation under the system of SA ensures that the CCCTB system is always preferable under such conditions. The interest taxation effect and – depending on the specific combinations in area a – the possibly preferable tax base allocation under the system of SA are not strong enough to lead to a change in the ranking of the tax systems.

In the following, we consider only the combinations above the line in Fig. 3. To compare the tax consequences under the CCCTB system with those under the system of SA, we first focus on combinations of only positive earnings of both companies in the first period (area b). For these combinations, the system of SA is always advantageous, mainly because the resulting losses of the second period may at least partially be carried back under the system of SA. In contrast, under the CCCTB system, the second period's loss may not be utilized at all during the time frame under review, but must be carried forward and is valued at $\theta^{CCCTB} = 45\%$. The tax base allocation effect and the dividend taxation effect play rather minor roles and are crucial only in marginal cases. As the French company does not lack liquidity in the first period, the interest taxation effect does not appear.

Next, we consider the tax consequences in the case where only one company incurs positive earnings

[32] Only in rare situations the tax base allocation under the CCCTB system and the system of SA might be lead to similar outcomes.

[33] Compare with area 1 of Fig. 1.

and the other company incurs negative ones (area c1 and c2). Here, whether one or the other tax system is advantageous depends on the specific combination of earnings of both companies. In area c2 (c1) the German (French) company may carry back its losses of the second period and the French (German) company must carry forward the losses of the first period under the system of SA. Under the CCCTB system, the profits and losses of each group company may be offset cross-border in each period. In both areas, the CCCTB is positive in the first period (all losses of the German (French) company may be offset cross-border in area c1 (c2)) and negative in the second period (the losses of the French (German) company exceed the profits of the German (French) company in area c1 (c2)). The system of SA is beneficial if the advantage from carrying back the second period's losses of the German (French) company (area c2 (c1)) is rather high. Specifically, the group benefits from SA if this advantage exceeds:

- the benefit from a cross-border loss-offset under the CCCTB system;
- the disadvantage of a loss carry-forward in the other company under SA in comparison to an immediate loss-offset under the CCCTB;
- the disadvantage of the dividend taxation effect in period 1 (2) in area c1 (c2); and
- in area c1, the disadvantage of the tax base allocation effect, which favours in this area the CCCTB system.

The main driver of the results is the loss utilization effect. The interest taxation effect and the tax base allocation effect favour the system of SA in area c2, as well. Only for these combinations may the group deduct interest in higher-taxed France and tax them in Germany, and only for these combinations more tax base is taxed in lower-taxed Germany under the system of SA than under the CCCTB system. Due to these two additional effects in favour of the system of SA, there are more combinations for which the system of SA is advantageous in area c2 than in area c1. As becomes apparent from Fig. 3, with increasing earnings of the company that may make use of the loss carry-back provision (the German (French) company in area c2 (c1)), the system of SA remains advantageous only for decreasing earnings of the other company. Under the system of SA, the relative share of utilizable losses decreases due to the loss carry-back restriction with increasing earnings, and thus the system of SA declines in its relative advantageousness. Thus, it can remain advantageous only if the profits and losses under the CCCTB system are very unbalanced and the advantage from the cross-border loss-offset is rather low. This is the case when the earnings of the other company decrease.

The following graph clarifies to what extent one or the other tax system is superior. It shows, by example, the future value of the group for fixed German earnings of -€ 30,000 in the first period and for varying earnings for the French group under both systems.

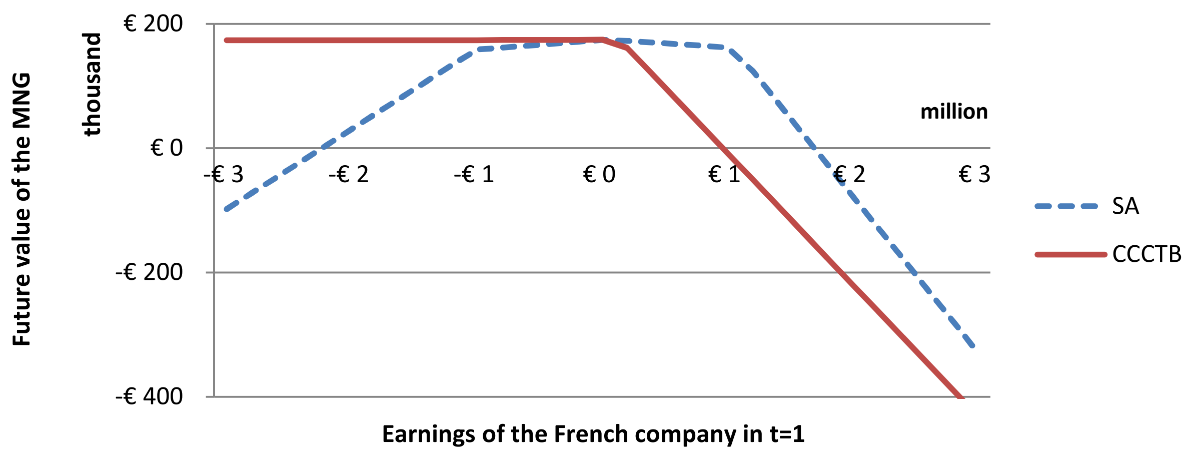


Fig. 4 Future value of the MNG for a fixed value of German cash flows less depreciation of € 0

The observable effects have been described previously. The graph shows that in the most extreme case (French earnings amount to -€ 3 million), the difference in future values between both systems amounts to approximately € 270,000. If the French earnings amount to € 0 the difference between both systems is the smallest with approximately € 900. The graph clarifies that the differences in future values between both systems vary considerably, from marginal to substantial differences.

The unlimited loss carry-forward provision without minimum taxation and the possibility of a cross-border loss-offset make the CCCTB system advantageous for most of the combinations considered. However, the system of SA becomes advantageous if the profit/loss streams allow the utilization of the loss carry-back provision. The dividend and interest taxation effect and the tax base allocation effect are not the main drivers of our results, but in borderline cases they can be decisive. In the next section we investigate the impact of the assumptions made for our model on our findings through a sensitivity analysis.

5.4 Generalization of the model

As the national loss-offset provisions in France and Germany are very specific, we broaden our analysis to draw more generalizable conclusions. To capture the share of losses that can be offset under national laws we introduce loss-offset coefficients. The resulting model can be regarded as representative for the provision designs observable across Europe. We still distinguish between loss carry-back and loss carry-forward provisions.

There are only five countries in the EU that allow for a loss carry-back. All of them are of high importance either from an economic perspective, i.e., magnitude of economic activities (France, Germany, UK) or from a tax planning perspective of MNGs within Europe (the Netherlands, Ireland). The UK, the Netherlands and Ireland allow carrying losses back for one year unrestricted in amount. However, all EU countries allow to carry losses forward. We distinguish three different categories of countries with different loss carry-forward provisions. First, there are countries that do not restrict loss carry-forwards at all; second, countries that restrict loss carry-forwards in amount; and third, countries that restrict them in time. The following table (Tab. 1) gives an overview of the loss-offset provisions across Europe (see IBFD 2015).

Loss carry-back, one year, if limited then maximal amount in brackets	France (€ 1 million), Germany (€ 1 million), Ireland, Malta, Netherlands, UK	
Unrestricted loss carry-forward	Belgium, Ireland, Latvia, Luxembourg, Malta, Sweden, UK	
Loss carry-forward restricted in amount (share of current year's taxable income against which losses can be offset)	Austria	75%
	Denmark	60%, but basic amount of DDK 7,747,500
	France	50%, but basic amount of € 1 million
	Germany	60%, but basic amount of € 1 million
	Hungary	50% and 5 years
	Italy	80%
	Lithuania	70%
	Poland	50% and 5 years
	Portugal	70% and 12 years
	Slovenia	50%
	Spain	depending on the turnover 25%-50% of losses can be offset in 2015, for future periods this share will be increased
Loss carry-forward restricted in time (years)	Bulgaria	5
	Croatia	5
	Cyprus	5
	Czech Republic	5
	Finland	10
	Greece	5
	Romania	7
	Slovak Republic	4, but losses carried forward evenly
	The Netherlands	9

Tab. 1 Loss-offset provisions in EU Member States

In the following, we use the set of equations as introduced in Section 4.1 and extend it with respect to differently determined loss-offsets LO_t^{SA} and loss carry-backs LCB_t. The factor η indicates the share of the adjusted gross income AGI of each company against which loss carry-forwards from previous periods can be offset. The factor π captures the share of the tax base of the previous period TB_{t-1} against which current losses can be offset. We then obtain

$$LO_t^{SA} = min\left\{LCF_{t-1}^{SA_{GER}}; max\{\eta * AGI_t^{SA}; 0\}\right\}, \tag{16}$$

$$LCB_t = \min\left\{\max\{\pi * \mathrm{TB}_{t-1}^{SA}; 0\}; \max\{-\mathrm{AGI}_t^{\mathrm{SA}}; 0\}\right\}. \tag{17}$$

A subset of EU countries allows to infinitely carry forward losses but has not implemented a loss carry-back provision in the national tax code. For such countries η is equal to one and π is equal to zero. In such cases the loss-offset provisions under separate accounting and CCCTB are identical, except for the cross-border loss-offset under CCCTB. We find that under such parameter settings for both countries the CCCTB system is always preferable for the MNG. The dividend and interest taxation effect and – depending on the combinations of earnings – the cross-border loss-offset or the higher valuation of remaining losses under the CCCTB system, respectively, are crucial for this result.

Under this set of parameters ($\eta = 1, \pi = 0$), we find more interesting results if we disregard the 5%-dividend taxation under the system of SA. Non-dividend taxation is representative for most EU countries as the 5%-dividend taxation exists only in four EU countries, i.e., Belgium, Italy, Germany and France. As shown in Fig. 5, the system of SA is preferable under such parameter settings for about one eighth of the illustrated combinations of French and German earnings. The advantageousness of the system of SA is solely caused by the tax base allocation effect, i.e., more losses are allocated to higher-taxed France under the system of SA than under the CCCTB system. Note that also for countries that restrict the loss carry-forward in time a picture similar to the one displayed in Fig. 5 emerges. Here, the pre-tax present value of earnings of € 100,000 of each company ensures that all of the first periods' losses can be utilized in the second period and that the timely loss-offset restrictions do not apply. Thus, the national tax codes of the vast majority of the EU countries provide conditions that lead to the system of SA being preferable for some combinations of French and German earnings only because of tax base effects. By contrast, assuming that the 5%-dividend taxation applies, the system of SA is preferable only for countries that allow for a loss carry-back.

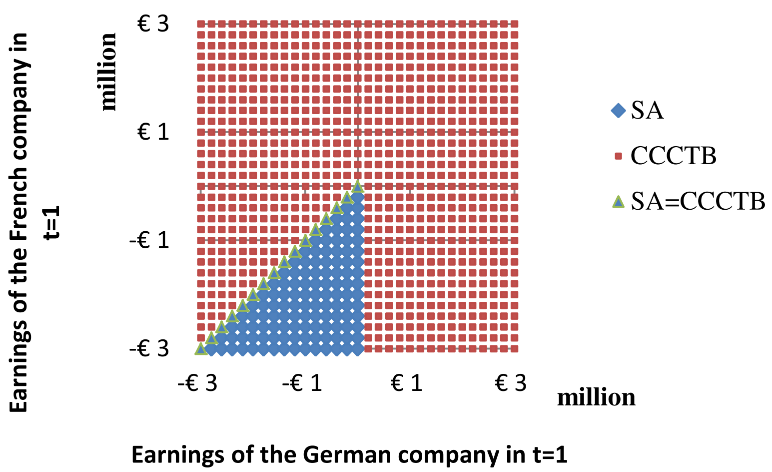


Fig. 5 SA vs. CCCTB, no dividend taxation, no loss carry-back $\pi = 0$, full loss carry-forward $\eta = 1$

We employ the example of domestic loss-offset possibilities in selected European countries to show how the relation between the loss carry-forward and carry-back provisions determines the relative advantageousness of the system of SA. First, taking the UK and Ireland as examples for non-dividend taxation, we investigate how an unlimited loss carry-forward and a one-year loss carry-back affect the relative advantageousness of the system of SA. Fig. 6 illustrates the results. 100% of all of the second periods' losses of each entity can be carried back and all of the first periods' losses can be utilized in the following period. Thus, the system of SA gains in relative advantageousness in comparison to the Franco-German case. As Fig. 6 shows in comparison to Fig. 4, there are significantly more cases in which the system of SA becomes preferable if the cash flow streams are opposing in their time pattern (see the enlargement of the blue triangular area to the upper left and the lower right corner in Fig. 6 in comparison to Fig. 4).

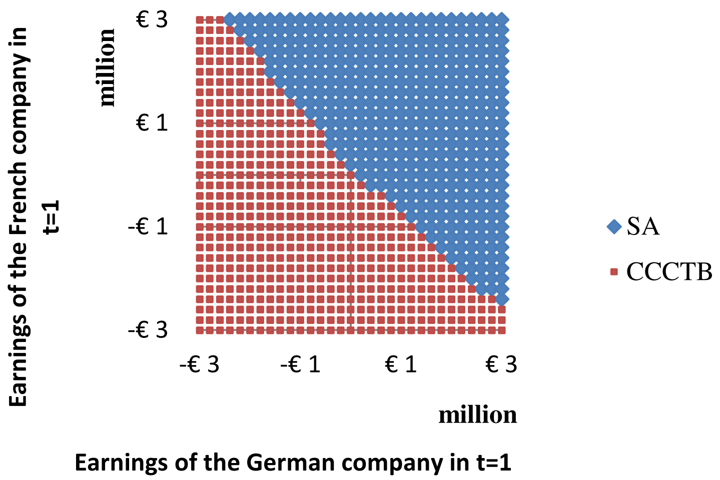
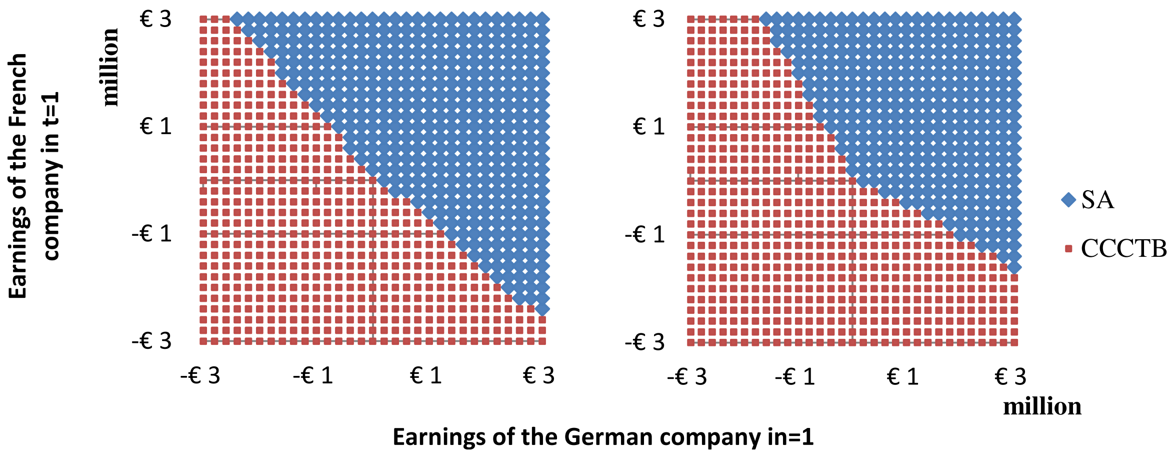


Fig. 6 SA vs. CCCTB, unrestricted loss carry-forward $\eta = 1$and loss carry-back $\pi = 1$

In a next step, we vary the parameters for the loss carry-forward and for the loss carry-back. First, we run the analysis assuming that a minimum taxation at a rate of 50% ($\eta = 0.5$) and a full loss carry-back ($\pi = 1$) applies, see Fig. 7, left graph. This case might appear in the Netherlands if loss carry-forwards cannot be entirely utilized as the time restriction applies. As a consequence, the present value of the resulting future tax refunds decreases, which is captured here by the coefficient η set equal to 50%. Second, we assume that only 50% of losses can be carried back ($\pi = 0.5$) but all of the losses can be carried forward without restrictions ($\eta = 1$), see Fig. 7, right graph. Within EU countries such a case cannot appear, since there is no country that restricts the loss carry-backs pro rata. However, we run this analysis because it gives insights in the relative importance of the loss carry-back in relation to the loss carry-forward provision and thereby opens our analysis to scenarios beyond the currently observable institutional settings in the EU.



Notes: left graph: unrestricted loss carry-forward $\eta = 1$, restricted loss carry-back $\pi = 0.5$; right graph: minimum taxation applies $\eta = 0.5$, full loss carry-back $\pi = 1$

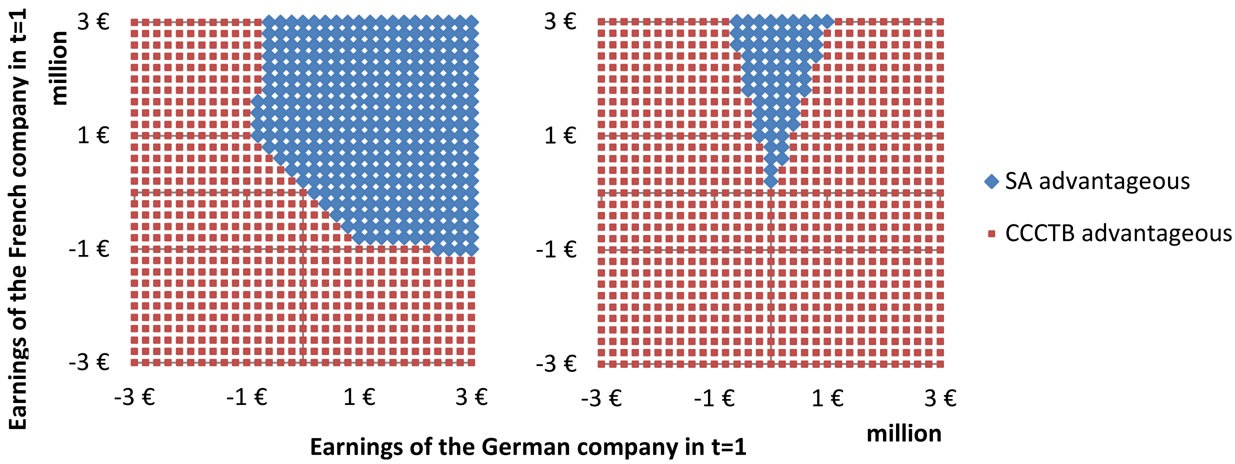
Fig. 7 SA vs. CCCTB, variation of loss carry-forward and carry-back parameters

Fig. 7 shows that the 50%-restriction of the loss carry-back or the loss carry-forward lead to approximately the same amount of cases in which the system of SA is advantageous. Both restrictions make the system of SA relatively less attractive for MNGs. The effects of both restrictions on the advantageousness of the system of SA are strictly linear. The higher the restriction, the smaller the future values under the system of SA.

5.5 Sensitivity analysis

In this subsection we examine the robustness of the previous results. To this end, different parameter variations are applied. If not stated differently the parameter settings are as in the Franco-German base scenario. In three steps, we analyse, *ceteris paribus*, the influence on the results of the evaluation of the remaining losses at the end of the second period, we allow for behavioural adjustments under the CCCTB system in order to take advantage of tax rate differentials and finally we have broadened the scope of the earnings for both group companies while retaining the parameter settings of the base scenario.

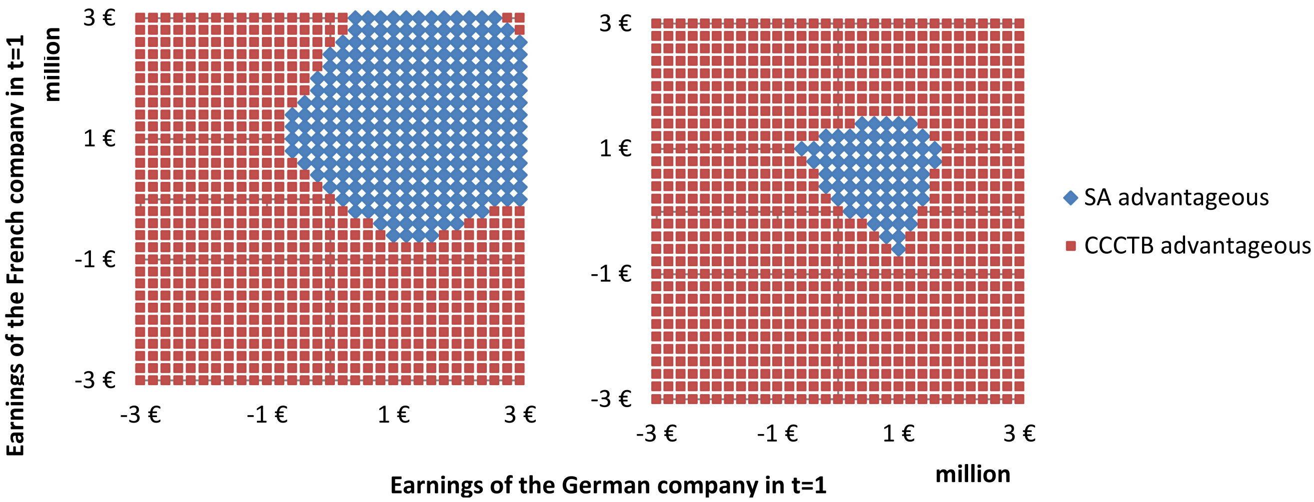
First, we analyse the impact of the valuation of the remaining loss carry-forwards at the end of the second period. In the basic scenario we argued that the chance for using losses entirely is higher under the CCCTB system. However, this must not necessarily be the case as under certain conditions the loss-offset under both systems might be similar. In order to find out to what extent the higher valuation of the remaining losses under the CCCTB system ($\theta^{CCCTB} = 45\%$) drives the results, we first assume that remaining losses are valued equally under both tax systems. Fig. 8 shows the results for the two extreme cases, i.e. that losses are not utilizable at all in the future (θ^{CCCTB}=θ^{SA}=0%) or that losses are fully utilizable (θ^{CCCTB}=θ^{SA}=100%) under both systems. By varying the portion of utilizable losses equally under both systems, the figures illustrate that higher loss utilization favours CCCTB. The CCCTB system turns to be advantageous in such areas in which the remaining loss carry-forwards are higher under the CCCTB system than under SA, i.e., in cases in which the MNG can make use of the loss carry-back provision under SA. Thus, if the valuation of the remaining loss carry-forwards is similar under both systems, the CCCTB system benefits more strongly from an increase in the level of loss utilization.



Notes: left graph: no loss carry-forward θ=0%; right graph: loss carry-forwards are valued at θ=100% under both tax systems

Fig. 8: SA vs. CCCTB depending on earnings of both companies, loss carry-forwards are valued equally under both systems

Next, we assume that the valuation of losses differs more fundamentally between the system of SA and the CCCTB system. Fig. 9 provides information on how much the CCCTB system benefits from a bigger valuation gap between the two systems. Even if the valuation difference of loss carry-forwards is 60 percentage points between the two systems (right graph of Fig. 9), there are some combinations under which the system of SA is still advantageous. The system of SA remains advantageous for those combinations that allow to carry the second period's losses completely back (i.e., the area in which the earnings of the first period are close to € 1 million).



Notes: left graph: θ^{SA} = 40%, θ^{CCCTB} = 60%; right graph: θ^{SA} = 20%, θ^{CCCTB} = 80%

Fig. 9: SA vs. CCCTB depending on earnings of both companies, different valuation of loss carry-forwards

The sensitivity analysis shows so far that the evaluation of losses has an impact on our results but does not affect them heavily. Even in extreme cases the conclusions drawn from the basic scenario hold.

Next, we extend our approach and account for behavioural reactions. We assume that the MNG can adjust the allocation of assets and labour between Germany and France in order to benefit from tax rate differentials under the CCCTB system. The allocation of sales between the two countries is – like in the base scenario – still determined by the cash flows in each country. We refer to studies on MNG's reactions to changed factor weights under the formulary apportionment system at the US state level to make an educated guess about the shifting potential. Those studies indicate that a change in factor weights effectuates a change in effective tax rates of US states. Whereas Weiner (1994) and Lightner (1999) did not find any significant evidence of MNG's reactions in factor allocation at all, Goolsbee and Maydew (2000) find evidence that a reduction in the labour factor weight from one third to one fourth increases employment in the manufacturing sector significantly by 1,1%. Consequently, empirical evidence from the US indicates that at least the short-term responses in activity shifting on tax rate differentials seem to be very small. However, conversely to empirical evidence, in order to scrutinize the impact of the shifting factor β, we assume that the MNG is able to shift 100% of assets and labour within its entities as the most extreme scenario. Fig. 10 illustrates the advantageousness of either tax system when the MNG shifts all of its assets and labour in the profit period to the lower-tax country Germany. As losses are not allocated to the group entities under the CCCTB system but rather carried-forward on the group level, the factor allocation does not change the relative attractiveness of this tax regime if the CCCTB is negative. Fig. 10 clarifies that even in this extreme setting, which highly overstates the empirical evidence from the US, our results remain robust. We conclude from this investigation that abstracting from behavioural responses under the CCCTB system is justified as the impact of such responses are rather negligible.

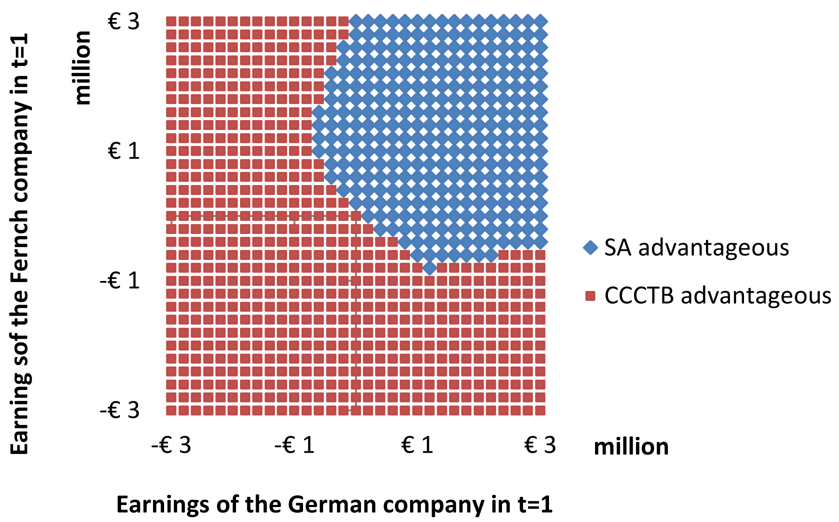


Fig. 10: SA vs. CCCTB depending on earnings of both companies, assets and labour can be fully shifted

Last but not least, we broaden the scope for the earnings to be considered. Instead of considering earnings from approximately minus € 3 million to plus € 3 million, as in the base scenario, we now consider earnings from approximately minus € 60 million to plus € 60 million.[34] The values for the German and French earnings are now plotted in increments of € 500,000. The parameter settings remain the same as those in the base scenario. The following graph shows only the results for positive earnings of both group companies (comparable to area b of Fig. 3). For the remaining combinations, the results do not add anything new to the findings of the base scenario.

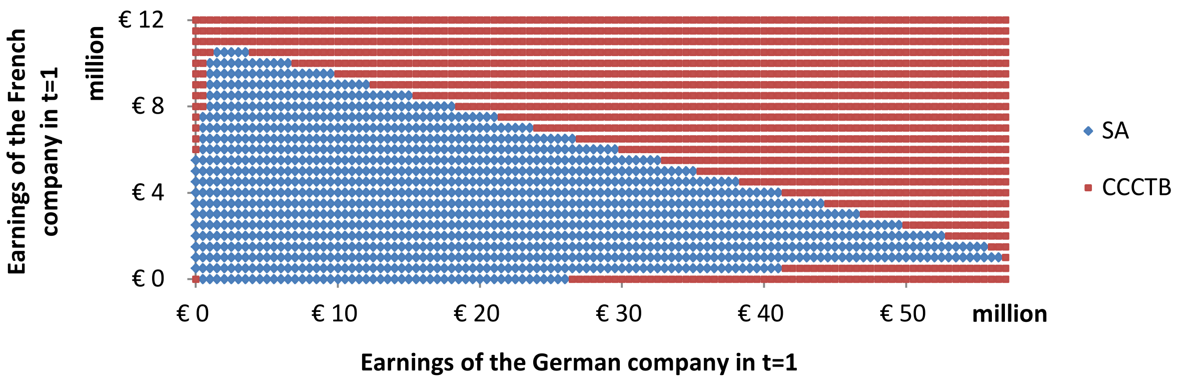


Fig. 11 SA vs. CCCTB depending on a broader scope of earnings

Fig. 11 shows that the system of SA is advantageous only up to a limited amount of positive earnings of the French and German company in the first period. The main reason for this is that there is a break-even-point where the advantage of the utilization of a larger share of losses under the system of SA due to the loss carry-back, is overcompensated by the effects of a higher value of the remaining losses at the end of the second period under the CCCTB system ($\theta^{CCCTB} = 0.45, \theta^{SA} = 0.4$).

The area in Fig. 11 for which the system of SA is advantageous is triangular shaped. The triangle can be described by its apexes and the point of origin. Specific combinations of German and French earnings determine the edge and apexes of the triangle, and thus the break-even point of SA and CCCTB's relative attractiveness. Under the given set of assumptions:

- the German earnings are limited to € 1 million and the French earnings are limited to € 10.5 million (top apex); or
- the French earnings amount to € 1 million and the German earnings amount to € 56.5 million (right apex)

in the first period to favour SA. The upper and right apex of the triangle result mainly from the loss carry-back provision under the system of SA: The relative advantage of the system of SA over the CCCTB system is highest if the earnings of German or French company takes on a value of € 1 million, as the benefit from the loss carry-back provision is maximal then. Due to the high relative advan-

[34] By considering a broader scope, the interest payments can be higher than € 150,000. See footnote 40. However, even in cases with high losses the thin capitalization rule does not apply for the French company because we assume that the indebtness condition (safe haven) is not violated. See Gaoua (2014), p. 26.

tageousness of the system of SA over the CCCTB system for earnings of € 1 million for one company in the first period, the system of SA remains advantageous even if the earnings of the other company are very high in the first period. Very high earnings in the first period imply that the share of utilizable losses is, due to the application of the loss carry-back restriction, rather low in the second period.

The CCCTB system turns out to be advantageous for lower French earnings (top apex) than for German earnings (right apex). There are two reasons for this imbalance. First, dividend taxation under the system of SA for increasing French earnings favours the CCCTB system. Second, the tax base allocation for increasing French earnings favours the CCCTB system, as well, because – compared to the system of SA – a lower share of the group tax base is taxed in higher-taxed France in the profit period.[35,36]

Our sensitivity analysis shows that the results are dependent on the evaluation of the remaining losses at the end of the second period. Improved utilization of the remaining losses under both tax systems has a clear effect in favour of the CCCTB system. Furthermore, the analysis reveals that allowing for behavioural adjustments under the CCCTB system changes the overall results only slightly in favour of the CCCTB system. Both of previous variations do not challenge the basic findings of our analysis. By broadening the magnitude for earnings of both group companies, we show that the advantageousness of the system of SA for positive French earnings is limited to rather low values.

6 Conclusion

We have analysed the conditions under which the CCCTB system or the system of SA will be advantageous for an MNG of which the member companies incur temporary losses. The focus on losses is particularly relevant and noteworthy, as the recent crisis led to enormous loss carry-forwards in MNGs and, furthermore, innovative activities like start-ups and R&D investment, which are crucial for MNG future performance, usually are characterized by initial losses. Against this background, it is vital to investigate the implications of the tax environment for temporarily loss-making MNGs.

While prior research focuses mainly on the differences in economic behaviour under both systems in general, we study the conditions under which one or the other tax system is preferable from the perspective of an MNG, with a particular focus on loss-offsets. We simulate possible decision scenarios of MNG to ascertain under which conditions MNGs are likely to opt for the CCCTB system. We focus on European MNGs with losses at the parent and subsidiary levels. We build a tailor-made, numerical model for a representative MNG. To demonstrate typical differences between the respective national

[35] The effects of the tax base allocation in the profit period exceed that of the loss period. See Section 5.3.

[36] By considering a broader scope of earnings, the tax base allocation effect becomes more important, as under separate accounting the allocation for the group tax base between the two companies can become more extreme. In some settings, low profits of one company meet very high profits of the other company. Thus, the first company maintains a very small share of the group tax base, while the latter company retains a very large one. In contrast, under the CCCTB system, the allocation of the tax base is smoother.

loss-offset provisions and that of the CCCTB system, we consider a group the parent of which is domiciled in Germany, with a subsidiary in France. France and Germany allow losses to be carried back. By considering different magnitudes and time sequences of profit/loss streams of each group company, we vary the degree to which the MNG may utilize its losses by carrying them back and/or forward. We aim to focus only on differences inherent in the tax systems. Thus, we disregard behavioural adaptations in order to reduce tax payments under the respective systems.

We find mixed results. We identify four effects that determine the decision of an MNG: the tax-utilization of losses, the allocation of the tax base to the respective group companies, dividend taxation and intragroup interest taxation. We find that the CCCTB system proves advantageous for increasing loss/profit streams (e.g. from start-ups or R&D projects) of the single group entities, whereas the system of SA is beneficial for decreasing profit/loss streams (e.g. caused by a decrease in return from a mature product). The loss-offset under the CCCTB system has two major advantages compared to the system of SA: no minimum taxation is applicable and cross-border loss-offsets are possible. The inherent advantage of the French and German national tax regimes under the system of SA, is the possibility to carry back losses. We conclude that the possibility of carrying losses back is decisive for the advantageousness of the system of SA in the Franco-German context.

If the MNG's entities carry out projects that result in opposing profit/loss streams, the CCCTB system will, in most cases, be advantageous, as losses may be offset cross-border. However, counter-intuitively, the CCCTB system is not unconditionally preferable in cases where a cross-border loss-offset is applicable. Rather, it is the magnitude of these entities' profits and losses that determines whether the CCCTB system is worthwhile. If the CCCTB is initially positive but becomes negative over time and, furthermore, if the relationship between the losses and profits of the respective group entities is rather unbalanced, the decision not to opt for the CCCTB system tends to be attractive. The reason is that losses may be utilized earlier under the system of SA, thanks to the loss carry-back provision. However, if the CCCTB is initially negative and becomes positive over time, the results of the analysis point towards choosing the CCCTB system, as in these constellations at least some of the losses may be utilized immediately, thanks to the cross-border loss-offset, while any remaining losses may be carried forward without limitation.

Furthermore, our findings suggest that the CCCTB system tends always to be advantageous if only one of the group companies incurs high initial losses that are followed by high profits. Such extreme profit/loss streams are typical for projects that involve high initial R&D expense, for example in the pharmaceutical industry. The advantageousness of the CCCTB system in such cases is explained by the application of the minimum taxation under the system of SA, which strongly restricts the loss-offset for the extreme profit/loss streams considered here.

Moreover, our analysis highlights the impact of the intercompany interest and dividend taxation on the advantageousness of the system of SA. Whereas the dividend taxation is always to the disadvantage of the system of SA, the intercompany interest taxation can favour it if the interest payments are deductible in the high-tax country. We broaden the Franco-German example towards a general European perspective and elaborate the effects resulting from differently designed loss-offset provisions and from different tax treatment of dividends. Addressing a variety of loss-offset provisions that exist across Europe allows us assessing more adequately how the design of loss-offset provisions impacts the advantageousness of each tax system. Taking exemplarily the UK and Ireland, we find that an unlimited loss carry-forward and a one-year loss carry-back favours the system of SA clearly. In such case the number of combinations for which the system of SA is advantageous increases by about 50%. Furthermore, the generalized model clarifies that in case of no dividend taxation and in case of an unlimited loss carry-forward and no loss carry-back (like, e.g., in Sweden or Luxembourg) the tax base effects alone ensure that the system of SA is advantageous for one eighth of combinations.

Our findings must be interpreted against the background of our set of assumptions. The results are partially driven by the evaluation of remaining losses at the end of the second period. A better utilization of losses may fundamentally benefit the CCCTB system. However, the results of the sensitivity analysis clarify that even if we vary the loss-offset possibilities strongly in favour of the CCCTB system, there still remain combinations for which the system of SA is advantageous. Thus, our basic conclusions are not challenged by the assumptions about the loss carry-forwards at the end of the second period. Furthermore, broadening the range of earnings reveals that the system of SA can be advantageous only for combinations that include relatively low profits of both companies in the first period. Consequently, the sensitivity analysis reveals that our outcomes are not limited to just specific numerical examples, but can – to some extent – be generalized. Moreover, the sensitivity analysis points out that our results change only marginally if we allow for behavioural adjustments under the CCCTB system in order to take advantage of tax rate differentials. Our results are helpful in revealing the conditions under which it is advisable to opt for the CCCTB system. Moreover, they may also contribute to the discussion of corporate group tax harmonization within other economic zones, such as the United States.

Our analysis contributes three important findings to the existing literature. First, in addition to the tax base allocation effect,[37] it identifies further determinants that potentially have a decisive influence on the choice of the preferable tax systems, namely the dividend and interest taxation effect and the loss utilization effect. Second, as some prior studies deny the economic significance of the loss carry-back provision (see Haegert and Kramm 1977; Dwenger 2008; Dreßler and Overesch 2013), our study demonstrates that this provision does have a significant impact at least with regard to the choice of the preferable tax system. Third, our study makes clear that the intercompany loss-offset across borders

[37] Prior analytical studies focus mainly on the tax base allocation influenced by income shifting (see Nielsen et al. 2010; Gérard and Princen 2012; Martini et al. 2012).

under the CCCTB system is not necessarily preferable over the intertemporal loss-offset under the system of SA.

Whether the CCCTB proposal will be adopted is, in fact, far from certain. In moving toward its adoption by the EU, there has been a public debate on various adjustments to its provisions. Two of the many aspects under discussion are whether a common tax base without consolidation (CCTB) could prove acceptable and whether to implement the minimum taxation based on the German model. Our results indicate that each of these amendments would have a fundamental impact on the relative advantageousness of the CCCTB system and would substantially decrease its attractiveness for MNGs. If both of the restrictions under discussion were applied, scarcely any incentive would remain for Franco-German MNGs to opt for the CCCTB system.

There are still several important issues that have not yet been sufficiently addressed. For instance, our results indicate the difficulty of determining the optimal timing for a company's decision to opt for the CCCTB system. This merits more careful examination in future research so that the overall tax effects in a dynamic setting that may arise as a consequence of the transition to the new system, can be anticipated.

References

Andersson K (2007) An Optional Common Consolidated Corporate Tax Base in the European Union. In: Andersson K, Eberhartinger E, Oxelheim L (eds) National Tax Policy in Europe – To Be or Not To Be? Heidelberg, pp 85-119

Ambagtsheer-Pakarinen L (2014) Denmark– Corporate Taxation. IBFD Publications, Amsterdam

Auerbach AJ (1986) The Dynamic Effects of Tax Law Asymmetries. Rev Econ Stud 53:205-225.

Auerbach AJ, Poterba JM (1987) Tax Loss Carryforwards and Corporate Tax Incentives, In Feldstein M (ed) The Effects of Taxation on Capital Accumulation. Chicago, pp 305-338

Barenfeld J (2007) A Common Consolidated Corporate Tax Base in the European Union – A Beauty or a Beast in the Quest for Simplicity? Bulletin for International Taxation 61:258-271

Barlev B, Levy H (1975) Loss Carryback and Carryover Provisions: Effectiveness and Economic Implications. Natl Tax J 28:173-184

Bäumer M (2011) Die Besteuerung multinationaler Unternehmen in der Europäischen Union. Hamburg

Bettendorf L, Devereux MP, van der Horst A, Loretz S, de Mooij RA (2010) Corporate Tax Harmonization in the EU. Econ Policy 25:537-590

Cooper MG, Knittel MJ (2010) The implications of tax asymmetry for U.S. corporations. Natl Tax J 63:33-62

Dahle C (2011) Der Einfluss von Mindestbesteuerungskonzepten auf unternehmerische Investitions-entscheidungen unter Berücksichtigung grenzüberschreitender Gruppenbesteuerungssysteme. Hamburg

Dahle C, Bäumer M (2009) Cross-Border Group-Taxation and Loss-Offset in the EU – An Analysis for CCCTB (Common Consolidated Corporate Tax Base) and ETAS (European Tax Allocation System). arqus Discussion Paper No. 66

Devereux MP, Loretz S (2008) The Effects of EU Formula Apportionment on Corporate Tax Revenues. Fisc Stud 29:1-33

Dietrich M, Kiesewetter D (2007) Auswirkungen einer Common Consolidated Tax Base auf Investitionsentscheidungen der Multinationalen Unternehmung. Betriebswirtschaftliche Forschung und Praxis 59: 498-516

Donnely M, Young A (2002) Policy options for tax loss treatment: How does Canada compare? Canadian Tax Journal 50:429-488

Dreßler D, Overesch M (2013) Investment impact of tax loss treatment – Empirical insights from a panel of multinationals. Int Tax Public Finan 20:513-543

Dwenger N (2008) Tax loss-offset restrictions – last resort for the treasury? An empirical evaluation of the tax loss-offset restrictions based on micro data. arqus Discussion Paper No. 44

Eberhartinger E, Petutschnig M, forthcoming, CCCTB – The Employment Factor Game, European Journal of Law and Economics

Egger P, Loretz S (2010) Homogeneous profit tax effects for heterogeneous firms? The World Economy 33:1023-1041

European Commission (2001) Company Taxation in the Internal Market, COM (2001) 582

European Commission (2006) Tax Treatment of Losses in Cross-Border Situations, COM (2006) 824

European Commission (2010) Your single market? Single Market Act for a highly competitive social market economy. Brussels

European Commission (2011) Proposal for a Council Directive on a Common Consolidated Corporate Tax Base, COM (2011) 121/4

European Commission (2015) Commission presents Action Plan for Fair and Efficient Corporate Taxation in the EU. http://europa.eu/rapid/press-release_IP-15-5188_en.htm. Accessed 11 August 2015

Fuest C, Hemmelgarn T, Ramb F (2007) How Would the Introduction of an EU-wide Formula Apportionment Affect the Distribution and Size of the Corporate Tax Base? An Analysis Based on German Multinationals. Int Tax Public Finan 14:605-626

Gallo G (2014) Italy – Corporate Taxation. IBFD Publications, Amsterdam

Gaoua N (2014) France – Corporate Taxation. IBFD Publications, Amsterdam

Gérard M, Princen S (2012) Investment and Financing Strategy of a Multinational Enterprise under Alternative Tax Designs. CESifo Working Paper No. 3838

Gérard M, Weiner JM (2003) Cross-Border Loss-Offset and Formulary Apportionment: How Do They Affect Multijurisdictional Firm Investment Spending and Interjurisdictional Tax Competition? CESifo Working Paper No. 1004

German Federal Bank [Deutsche Bundesbank] (2015a) "Effektivzinssätze Banken DE / Bestände / Einlagen nichtfinanzieller Kapitalgesellschaften, vereinbarte Laufzeit von über 2 Jahren". http://www.bundesbank.de/SiteGlobals/Forms/Suche_Statistik/Statistiksuche_Text_Formular.html?resourceId=30070&searchIssued=0&submit=Suchen&freeSearch=Zinss%C3%A4tze&pageLocale=de&input_=150&searchIssued.HASH=b1ca7878d0a61454ba56&pageBlock=1#resultTable. Accessed 3 August 2015

German Federal Bank [Deutsche Bundesbank] (2015b) „Effektivzinssätze Banken DE / Bestände / Kredite an nichtfinanzielle Kapitalgesellschaften, Ursprungslaufzeit über 1 bis 5 Jahre". http://www.bundesbank.de/SiteGlobals/Forms/Suche_Statistik/Statistiksuche_Text_Formular.html?resourceId=30070&searchIssued=0&submit=Suchen&freeSearch=Zinss%C3%A4tze&pageLocale=de&input_=150&searchIssued.HASH=b1ca7878d0a61454ba56&pageBlock=1#resultTable. Accessed 3 August 2015

German Federal Ministry of Finance (2012) Franco-German green paper on convergence in business taxation. http://www.bundesfinanzministerium.de/Content/EN/Standardartikel/Topics/Europe/Articles/2012-02-08-Franco-German-green-paper.html. Accessed 24 October 2013

Goolsbee A, Maydew EL (2000) Coveting they neighbor`s manufacturing: The dilemma of state income apportionment. J Public Econ 75:125-143

Haegert L, Kramm R (1977) Die Bedeutung des steuerlichen Verlustrücktrags für die Rentabilität und das Risiko von Investitionen. Zeitschrift für Betriebswirtschaftliche Forschung 29:203-210

IBFD (2015) Tax research database. Amsterdam: International Bureau of Fiscal Documentation

Kager R, Schanz D, Niemann R (2011) Estimation of Tax Values Based on IFRS Information: An Analysis of German DAX30 and Austrian ATX Listed Companies. Accounting in Europe 8: 89-123

Klassen KJ, Shackelford DA (1998) State and provincial corporate tax planning: Income shifting and sales apportionment factor management. J Account Econ 25:385-406

Kiesewetter D, Mugler J (2007) Gewinnverlagerung im EU-Konzern bei Besteuerung nach dem Trennungs- und dem Einheitsprinzip. Die Betriebswirtschaft 67: 503-518

Kiesewetter D, Steigenberger T, Stier M (2014) Can formula apportionment really prevent multinational enterprises from profit shifting? – the role of asset valuation, intragroup debt, and leases. arqus Discussion Paper No. 175

Lightner, T. (1999) The Effects of the Formulary Apportionment System on State-Level Economic Development and Multijurisdictional Tax Planning. Journal of the American Accounting Association, 21 (Supplement): 42-57

Lyon AB, Silverstein G (1995) The alternative minimum tax and the behavior of multinational corporations. In: Feldstein M (ed) The Effects of Taxation on Multinational Corporations. Chicago, pp 153-177

Majd S, Myers SC (1987) Tax asymmetries and corporate income tax reform. In: Feldstein M (ed) The Effects of Taxation and Capital Accumulation. Chicago, pp 343-373

Martini JT, Niemann R, Simons D (2012) Transfer pricing or formula apportionment? Tax-induced Distortions of Multinationals´ Investment and Production decisions. Contemp Account Res 29:1060-1086

Meller D (2010) Der institutionelle Gläubigerschutz in der Europäischen Privatgesellschaft (SPE). Frankfurt a. M.

Mintz J, Smart M (2004) Income shifting, investment, and tax competition: Theory and evidence from provincial taxation in Canada. J Public Econ 88:1149-1168

Nielsen SB, Raimondos-Møller P, Schjelderup G (2003) Formula Apportionment and Transfer Pricing under Oligopolisitc Competition. Journal of Public Economic Theory 5: 419-437

Nielsen SB, Raimondos-Møller P, Schjelderup G (2010) Company Taxation and Tax Spillovers: Separate Accounting versus Formula Apportionment. Eur Econ Rev 54:121-132

Niemann R (2004a) Asymmetric Taxation and Cross-Border Investment Decisions. CESifo Working Paper No. 1219

Niemann R (2004b) Investitionswirkungen steuerlicher Verlustvorträge – Wie schädlich ist die Mindestbesteuerung? Zeitschrift für Betriebswirtschaft 74:359-384

Niemann R, Treisch C (2006) Investitionswirkungen der Gruppenbesteuerung – Die österreichische Steuerreform als Vorbild für die deutsche Organschaft? Zeitschrift für Betriebswirtschaftliche Forschung 58:1013-1032

Oestreicher A, Keser C, Kimpel G (2013) The CCCTB option – an experimental study. Oxford University Centre for Business Taxation. WP 14/04

Oestreicher A, Koch R (2011) The Revenue Consequences of Using a Common Consolidated Corporate Tax Base to Determine Taxable Income in the EU Member States. FinanzArchiv 67:64-102

Perdelwitz A (2014) Germany – Corporate Taxation. IBFD Publications, Amsterdam

Piot W, Sigurdardottir B, Rasch M (2011) Impact of the European Commission`s Common Consolidated Corporate Tax Base Proposals. International Transfer Pricing Journal 18:415-418

Pummerer E, Steckel R (2005) Die österreichische Gruppenbesteuerung unter Unsicherheit. Zeitschrift für Betriebswirtschaft 75: 1099-1123

Sageworks, a financial information company (2014) The 15 Most Profitable Industries. https://www.sageworks.com/pdf/Data_Release_08062014.pdf. Accessed 11 August 2015

Schanz D, Schanz S (2011) Business Taxation and Financial Decisions. Heidelberg

Scheffler W (2005) Grenzüberschreitende Verlustverrechnung – Nachversteuerungsmethode im Vergleich zum geltenden Recht und zur konsolidierten Körperschaftsteuer-Bemessungsgrundlage. Betriebswirtschaftliche Forschung und Praxis 57: 156-174

Scheffler W, Schöpfel H, Köstler M, Binder S (2013) Konsequenzen der GKKB für die Gewerbesteuer. Steuer und Wirtschaft 90:28-38

Schneider D (1988) Was verlangt eine marktwirtschaftliche Steuerreform: Einschränkung des Verlust-Mantelkaufs oder Ausweitung des Verlustausgleichs durch handelbare Verlustverrechnungs-gutscheine? Betriebs-Berater 43:1222-1229

Schuchter Y, Kras A (2014) Austria – Corporate Taxation. IBFD Publications, Amsterdam

Spengel C, Endres D, Finke K, Heckemeyer J (2014) Effective Tax Levels Using the Devereux/Griffith Methodology. Centre for European Economic Research, Project for the EU Commission, TAXUD/2013/CC/120. Mannheim, Oxford

Sureth C, Bäumer M (2010) Besteuerung multinationaler Unternehmen in der EU – eine vergleichende Analyse ausgewählter Reformvorschläge. Zeitschrift für Betriebswirtschaft 80:171-202

Sureth C, Mehrmann A, Dahle C (2010) Grenzüberschreitende Verlustverrechnungssysteme in Europa – Vorbilder für eine Reform der deutschen Organschaft? Steuer und Wirtschaft 87:160-176

The World Bank (2012): GDP, PPP (current international $). http://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD/countries/order%3Dwbapi_data_value_2012%20wbapi_data_value%20wbapi_data_value-last?order=wbapi_data_value_2012%20wbapi_data_value%20wbapi_data_value-last&sort=desc&display=default. Accessed 16 March 2014

Temme M, Sporken E, Okten R (2011) Why Reinvent the Wheel in the European Union? The Common Consolidated Corporate Tax Base Proposal. International Transfer Pricing Journal 18:323-331

Weiner, J.M. (1994) Company Taxation for the European Community. How Sub-National Tax Variation Affects Business Investment in the United States and Canada. PhD diss, Harvard University, Cambridge, USA

Paper 2:

Uncertainty in Weighting Formulary Apportionment Factors

How does weighting uncertainty impact after-tax income of multinational groups?

Regina Ortmann

Uncertainty in Weighting Formulary Apportionment Factors

How does weighting uncertainty impact after-tax income of multinational groups?

Unsicherheit bei der Gewichtung von Formula Apportionment Faktoren

Wie beeinflusst Gewichtungsunsicherheit das nachsteuerliche Einkommen von multinationalen Konzernen?

Regina Ortmann, M.Sc.

regina.ortmann@upb.de

DIBT Doctoral Program in International Business Taxation at Vienna University of Economics and Business, Welthandelsplatz 1, 1020 Vienna, Austria, and

University of Paderborn, Department for Taxation, Accounting, and Finance, Chair of Business Administration, especially Business Taxation, Warburger Straße 100, 33098 Paderborn, Germany.

Uncertainty in Weighting Formulary Apportionment Factors

How does weighting uncertainty impact after-tax income of multinational groups?

Regina Ortmann*

Abstract

Formulary apportionment is an intensively debated mechanism for allocating tax base within multinational groups. Systems under which the formula is identical in all jurisdictions and systems under which jurisdictions can determine the weights on the formula factors individually can be observed. The latter systems produce uncertainty about the overall tax-liable share of the future group tax base. Counter-intuitively, I identify scenarios under which increased uncertainty leads to higher expected future group income. My results provide helpful insights for firms and policy makers debating the specific design of a formulary apportionment system.

Keywords: CCCTB, factor weights, formulary apportionment, tax uncertainty

I would like to thank Caren Sureth, Eva Eberhartinger, Erich Pummerer, Thomas Hoppe, the participants of the Research Interaction Forum of the 2014 American Accounting Association Annual Meeting in Atlanta, the participants of the 2014 European Accounting Association Annual Meeting in Tallinn, the participants of the 2014 Doctoral Seminar in Taxation at Vienna University of Economics and Business and the members of the DIBT Doctoral Program in International Business Taxation at Vienna University of Economics and Business for their helpful comments. Any remaining errors or inaccuracies are, of course, my own. Financial support from the Austrian Science Fund (FWF grant W 1235-G16) is gratefully acknowledged.

Unsicherheit bei der Gewichtung von

Formula Apportionment Faktoren

Wie beeinflusst Gewichtungsunsicherheit das nachsteuerliche Einkommen von multinationalen Konzernen?

Zusammenfassung

Formula Apportionment ist derzeit ein intensiv diskutierter Ansatz zur Aufteilung der Bemessungsgrundlage von multinationalen Konzernen. Dabei können Systeme, bei denen die Aufteilungsformel in allen Jurisdiktionen gleich ist und solche, bei denen die Jurisdiktionen die Faktorengewichtungen individuell bestimmen können, unterschieden werden. Das letztere System verursacht Unsicherheit über die Höhe der Konzernbemessungsgrundlage. Die Ergebnisse zeigen, dass unter bestimmten Umständen erhöhte Unsicherheit zu höheren Erwartungen über das zukünftige nachsteuerliche Einkommen des Konzerns führen kann. Die Ergebnisse helfen, die Wirkungen von Formula Apportionment Systemen auf Konzerne zu antizipieren und können damit in Steuerreformdiskussionen unterstützend eingesetzt werden.

Stichwörter: GKKB, Gewichtung von Faktoren, Formula Apportionment, Formelzerlegung, Unsicherheit

1 Introduction

The allocation of the corporate tax base between entities of multijurisdictional groups (MJGs) is gaining importance in a globalized world. Current statistics confirm that companies operate more and more internationally. According to the OECD International Direct Investment Statistics 2013, the global FDI inward and outward positions increased strongly over the last decades. Moreover, as forecasted by the World Investment Report 2013 of the UNCTAD, global foreign direct investment is expected to further increase over the next years (cf. UNCTAD, 2013, p. 18).[1]

Jurisdictions increasingly have to deal with how and especially where to tax the profits from such multijurisdictional activities. When it comes to taxation, the coordination between jurisdictions is very difficult. Allocating tax revenues via double tax treaties results frequently in over- or undertaxation of MJGs. An alternative method is a common tax system between the jurisdictions that is based on formulary apportionment. Unexpected at first sight, depending on the degree of coordination in the allocation process, formulary apportionment may also cause cases of over- or undertaxation, which need to be investigated in detail.

Under formulary apportionment the overall tax base of an MJG is allocated to each group entity by using a formula that is supposed to determine the share of economic activity of each entity. This approach is already used on the subnational level in several countries; e.g. the US, Canada, Switzerland and Germany.[2] Formulary apportionment is a hot topic that is currently being discussed by the OECD with reference to the tax base allocation of MJGs on a global level (cf. Center for Tax Policy and Administration, OECD, 2010, pp. 8-9), as well as by the European Commission (EC) in connection with the implementation of a Common Consolidated Corporate Tax Base (CCCTB) between EU Member States.

[1] The internationalization of transnational companies grew in 2012, with foreign affiliates' value added and exports rising moderately, cf. UNCTAD 2013, p. 23, Kelly 2001, p. 539.

[2] In Canada, Switzerland and the US, formulary apportionment is used to allocate the corporate income tax. In Canada, it is applied on the level of the provinces, in Switzerland on the level of the cantons and in the US on the state level. In Germany, formulary apportionment is used to allocate the local business tax between the municipalities.

In March 2011, the EC submitted a proposal for a Council Directive on a CCCTB (cf. European Commission, 2011). Under the proposed system, the apportionment formula will consist of the three equally weighted factors of assets, labor and sales. However, whether this proposed system will come into force is far from clear. The Member States face enormous difficulties in agreeing on a common system, as they fear losing too much of their tax sovereignty (cf. European Economic and Social Committee, 2011, para. 3.6). A possible way of assigning more sovereignty to the Member States would be to entitle them to determine the weights of apportionment factors on their own instead of applying uniform formulas in all jurisdictions. In line therewith, Michel Aujean, the former director of the tax policy department at the European Commission, recommended leaving the decision on how to weight each of the apportionment factors to the Member States (cf. Aujean cited by Weiner, 2008b). Furthermore, Anand and Sansing (2000) suggest that "a move towards a system of formulary apportionment in which formulary weights are equalized across countries is likely to be fragile". They justify this claim with different underlying economic characteristics of the jurisdictions that incentivize the jurisdictions to deviate from a uniform formula. Anand and Sansing's study focuses on US states, which are likely to be more homogenous in their economic makeup than EU Member States. Thus, they expect that incentives to deviate from a uniform system will be even stronger within EU Member States.

Nevertheless, in the end, the idea of individually-determined factor weights was not included in the current CCCTB proposal. The CCCTB Working Group stated that it "[…] is extremely important that the formula is uniform across all M[ember] S[tates], i.e., that M[ember] S[tates] should not be allowed to apply domestic variations to the formula by attributing different weights to the formula" (CCCTB Working Group, 2007, p. 6). However, as long as the Member States cannot agree on a common formula, it is likely that the idea of individually-determined factor weights will continue to be debated in the EU tax reform discussion.

In the following, I refer to a system under which all jurisdictions are bound to use exactly the same formula as the "common system". If each jurisdiction is allowed to determine the weights on the factors individually ("individual system"), then the share of the group tax base that is subject to taxation depends on two conditions: the factor weights and the share of each factor prevalent in each jurisdiction. Under a system of individually-determined factor weights per jurisdiction, more or less than 100% of the overall group tax base can be subject to taxation. Thus, depending on the factor weights and the allocation of factors among the jurisdictions, MJGs can be advantaged or disadvantaged by the individual system, since they may have to pay either more or less taxes than under the common system. Since the jurisdictions are free to change the factor weights under the individual system at any time and thereby determine the tax-liable share of the group tax base, the individual system results in tax base uncertainty. By contrast, the common system does not produce tax base uncertainty since all jurisdictions are bound to apply exactly the same formula. Hence, even if jurisdictions agree on changing their common apportionment formula, it is still guaranteed that exactly 100% of the overall group tax base is tax-liable. MJGs have to consider the uncertainty implied by the individual system for their future tax and financial planning.

In this paper I examine how the uncertainty in the design of apportionment formulas impacts the tax-liable share of the tax base and consequently the expected after-tax income of an MJG. As a consequence of this uncertainty, future factor weights are likely to develop as a random walk with up- and downward movements. By assuming equal tax rates in all jurisdictions, I focus on the share of the overall group tax base that is subject to taxation. I compare the (expected) after-tax income of MJGs under the individual and the common system, using the results under the common system as a benchmark. I model a two-jurisdictions-two-entities setting and refer to the (expected) after-tax future value as the criterion representing the expected future income of the group.

I find that uncertainty ambiguously affects MJGs income expectations and is likely to prevent efficient tax planning. Uncertainty increases the expectations about the after-tax income under the individual system for a profit-making MJG. In such a case the expected future values increase with increasing factor weight uncertainty. These results contradict the rather popular view that tax uncertainty generally dampens future income expectations (cf. for example, Bloom et al., 2013, IHK, 2013, Misik, 2012). The surprising outcomes are driven by interest effects in multiperiodical settings.

The results may be helpful for policy makers debating the design of a formulary apportionment system, and also for MJGs that are located in jurisdictions considering the implementation of such a system. Since EU Member States have not yet been willing to agree on the CCCTB as proposed by the EC, the idea of an individual formula design by each Member State may merit further discussion. From the analysis some conclusions about potential responses of MJGs to such a system can be derived. Furthermore, the results may promote discussions about the formula design in countries, that already apply formulary apportionment systems, i.e. Switzerland, Canada, the US and Germany.

After providing an overview of the relevant literature in the following section, I explain the model in Section 3. First, I introduce a model to determine the future value under the common system; and then for the expected future value under the individual system. Subsequently, in Section 4, I present the results on the impact of uncertainty on the expected future value of MJGs. Section 5 summarizes and interprets the findings.

2 Literature

There are two streams of literature to which this study contributes: on the one hand, literature that focuses on the impact of tax uncertainty on investment decisions; on the other, literature related to the design of apportionment formulas for allocating group tax bases within jurisdictions.

There is a vast body of analytical and empirical literature concerned with tax uncertainty[3] yet to my knowledge there is no paper that addresses uncertainty resulting from the uncoordinated tax allocation between jurisdictions. From a practical point of view, formulary apportionment is becoming increasingly important as a mechanism for tax base allocation but has not yet been thoroughly investigated analytically. It is therefore crucial to develop a suitable theoretical framework to study the effects that arise from tax allocation uncertainty.

Much of this literature explores the effects of tax rate or tax base uncertainty on investment behavior. Niemann (2004) analyzes the impact of uncertainty in tax rates on individual investment behavior. In

[3] For a brief overview on analytical research on the interplay of uncertainty and taxes see, for example, Alvarez and Koskela, 2008. Cf. further, MacKie-Mason, 1990, Alvarez et al., 1998, Sureth, 2002, Niemann/Sureth, 2004, Gries et al., 2012. An overview about the empirical literature provide, for example, Blouin et al., 2012, Stomberg, 2013, Edmiston, 2004.

line with my approach, he uses a binomial process to capture uncertainty. He compares expected after-tax future values of a real and a financial investment project under uncertain future tax rates. The outcome of the analysis is ambiguous: depending on the cash flow and depreciation streams, real investment may be encouraged or discouraged. Congruent with my results, he finds that the impact of the tax rate uncertainty on the expected future value is positive for a positive tax base. Taking irreversibility into account, Niemann (2011) probes the effects of tax uncertainty on investment behavior. Tax rate and tax base uncertainty is represented by tax payments that follow an arithmetic Brownian motion. Furthermore, stochastic cash flows are also assumed to follow an arithmetic Brownian motion. He finds that increased tax rate uncertainty does not necessarily delay investment. Auerbach and Hines (1988) examine historical patterns of corporate investment incentives in the US and find that expectations about uncertain future tax changes significantly affect the investment incentives only if adjustment costs were low. In a broader setting, Agliardi (2001) and Panteghini and Scarpa (2003) focus on policy changes in general instead of tax changes in particular. They find that regulatory risk has ambiguous effects on investment decisions. Congruent with my results, they show that regulatory risk does not necessarily have negative consequences.[4]

Another stream of the literature on uncertainty focuses on the impact uncertainty in tax parameters has on welfare. This literature also plays an important role in the present analysis, as welfare and (expected) future income of MJGs are to some extent related. In this respect, Alm (1988) examines how individuals respond to greater uncertainty concerning individual income tax. He distinguishes between tax base and tax rate uncertainty and finds that simply altering the likelihood of possible changes in tax policy already has an effect on investment behavior, even if the changes are not made in the end. A greater tax base risk may increase the expected tax collections of the government. Skinner (1988) investigates the impact of uncertain tax policy on savings, labor supply, and welfare in the US. He finds that removing future tax policy uncertainty can result in an annual welfare gain of 0.4 percent of national income.

[4] For more literature on regulatory uncertainty see Pawlina/Kort, 2005 and Bloom et al., 2007. See also Gries et al., 2012.

The second literature stream pertinent to this study analyzes formulary apportionment and factor weights. Some studies investigate the externalities resulting from uncoordinated factor weights. While I focus on the consequences of the externalities for the after-tax income, the existing literature centers mostly on consequences for social welfare in a game theoretic framework.

In this regard, Anand and Sansing (2000) examine theoretically why jurisdictions choose different weights in the apportionment formula for corporate income tax purposes. They find that the aggregate social welfare is maximized when all states use exactly the same formula. However, since a state can increase its individual welfare by deviating from this formula, it has a unilateral incentive to do so. Furthermore, Anand and Sansing show that, depending on their industrial makeup, jurisdictions follow different strategies to set the factor weights.

Furthermore, Weiner (2008) and Edmiston (2002) give suggestions for the design of formulary apportionment systems based on the experiences gained in the US. Weiner (2008) recommends that EU Member States should attempt to agree on a coordinated formula; otherwise they may face prisoner’s dilemma where each Member State makes the others worse off by trying to reach its individual revenue goals. Weiner further states that side payments should be made between Member States for the sake of reaching a coordinated solution. Using US data, Edmiston (2002) examines how the factor choice of a state impacts choices of other states. Using an applied general equilibrium model, she finds that the best economic development strategy of a given state is to choose a single-factor sales formula. However, this beneficial effect is supposedly short-term since the other states may change their formulas as well. Therefore, Edmiston suggests that states would be better off had they not started to play the “strategic apportionment formula” game. While both Weiner and Edmiston suggest applying a common formulary apportionment system from a social welfare point of view, the results of my study indicate that their suggestions are not necessarily preferable from a firm level point of view.

3 Model

I consider an MJG that is conducting business in two different jurisdictions. One group entity is located in jurisdiction 1 and the other entity in jurisdiction 2. The MJG faces the hypothetical decision of whether to carry out a real investment under the common system or under the individual system. The investment is assumed to generate yearly cash flows and depreciation. Interest payments are taxed similarly to regular business income. Furthermore, I assume that surplus liquid funds are reinvested in the capital market. If the group is short on funds, it may borrow funds from the capital market to fill the gap. The pre-tax debit interest rate is assumed to be equal to the pre-tax credit interest rate.

It is postulated that both jurisdictions have agreed on allocating the overall group tax base to the respective entities by formulary apportionment. I assume the application of a three-factor apportionment formula, as implemented in the US or as proposed for the CCCTB project, with the factors sales (s), labor (l) and assets (a)[5]. The sum of these three factor weights amounts always to 100% per jurisdiction. Whereas the labor factor only consists of payrolls in the US, it consists under the proposed CCCTB of equal shares of payrolls and number of employees. However, since the labor factor l is exogenously given in my model, its particular makeup is not crucial for the analysis. The share of each factor that is apportioned to the entity located in jurisdiction 1 is determined as follows:

$$a = \frac{assets\ of\ entity\ 1}{assets\ of\ the\ entire\ group,} \tag{1a}$$

$$l = \frac{labor\ of\ entity\ 1}{labor\ of\ the\ entire\ group,} \tag{1b}$$

$$s = \frac{sales\ of\ entity\ 1}{sales\ of\ the\ entire\ group.} \tag{1c}$$

The factor shares a, l and s take on values between zero and one and are assumed to be constant over time. In fact, rational market actors are expected to make use of preferential tax effects and respond to changed factor weights by shifting labor and assets. However, the assumption of constant factor shares is, at least in the short-term perspectives, widely in line with empirical evidence[6] and rules out any

[5] On the US state level the factor is called "property". The definitions of the asset factor under the CCCTB system and the property factor on the US state level are pretty much identical. I refer to this factor in line with the CCCTB wording as the asset factor. This is just an issue of wording and has no impact on the results.

[6] Several studies examine behavioral changes associated with changed factor weights on the US state level. While some studies find no significant behavioral responses, i.e., Weiner (1994) and Lightner (1999), others identify small reactions, i.e., Goolsbee and Maydew (2000) and Gupta and Hofmann (2000). In a cross-sectional study, Weiner finds no association between the apportionment formula design and investments in that state. In a further study from 1999 she finds an association yet the effects are tiny and only marginally significant. Moreover, Lightner (1999) examines the impact of the apportionment formula on employment growth yet also finds no significant association between them. However, Goolsbee and Maydew (2000) use a richer and more detailed panel data set than Lightner and find that reducing the weight of the labor factor from

kind of real activity shifting from the analysis. Disregarding real activity shifting allows for the separation of behavioral effects and uncertainty effects inherent in the individual system. Nonetheless, due to this assumption, my results may be biased towards the disadvantage of the individual system, as the expected after-tax future cash flows would be higher if the MJG could respond to changes in factor weights.

The share a becomes one if only the entity located in jurisdiction 1 has assets and the entity located in jurisdiction 2 has none. The share of each factor apportioned to entity 2 is obtained by subtracting the share of the respective factor in jurisdiction 1 from one. Thus, in the previously mentioned example the share of assets held by entity 2 is equal to zero. I assume that jurisdictions determine the weight γ on the sales factor and allocate the remaining weights equally on the asset and labor factor ($\frac{1-\gamma}{2}$). Thus, the weight of the sales factor determines the weights on the asset and labor factor as well. This approach is in line with the setting of factor weights in all states of the US and with the proposed CCCTB system in Europe. Consequently, taxes that have to be paid in jurisdiction 1 $(TP)_1$ are determined as follows:

$$TP_1 = \left(\gamma \cdot s + \frac{1-\gamma}{2}(l + a)\right) TB \cdot \tau \quad \text{with} \quad TB = CF - D, \tag{2}$$

where TB denotes the group tax base, CF the cash flows, D the depreciation and τ the tax rate.

Assuming equal tax rates[7] (cf. Anand/Sansing, 2000, p. 186.) in both jurisdictions allows me to focus on the share of the group tax base that is subject to taxation. Further ambiguous effects resulting from the interaction of tax rate differences and tax bases are thereby eliminated from the analysis. A time horizon of two periods is sufficient for the purpose of this paper, as the results are systematically similar for broader time horizons.

one third to one fourth significantly increases manufacturing employment in an average state by 1.1%. Furthermore, Gupta and Hofmann (2000) find that the elasticity of corporations' new capital expenditures in the manufacturing sector ranges between 0.05 to 0.35 depending on the income tax burden on property (measured as the product of the property factor weight and the statutory tax rate). Even in the studies that find behavioral adjustments of companies to changed apportionment factors, the effects are rather small. Thus, in line with the empirical literature, I believe it is justifiable to neglect them in this analysis.

[7] As a starting point, this simplifying assumption is also made by Nielsen et al., 2010, p. 131.

In the following, I assume risk neutral decisions-makers.[8] Even though the examination of risk-averse decision-makers would be desirable, I assume risk neutral ones here for the following reason. As I compare a system that results in a tax base risk (individual system) with a system that is fully certain with respect to the tax-liable share of the tax base (common system), the direction of impact of risk aversion is clear and unambiguous: higher risk aversion makes the individual system relatively less attractive compared to the common system. Therefore, accounting for risk-averse decision makers would not bring any valuable insights but would rather add a lot of complexity to the model. In order to focus on the inherent effects of the individual system and to keep the model as simple as possible I assume risk neutral decision-makers. However, due to this assumption my results may be biased in favor of the individual system.

3.1 Common system

Assuming that both jurisdictions have agreed on a common formula, the after-tax net cash flow of the group in each period t is determined as follows:

$$\begin{aligned} NCF_t &= CF_t - TB_t \cdot \tau \underbrace{\left(\gamma \cdot s + \tfrac{1-\gamma}{2}(a+l) + \gamma\,(1-s) + \tfrac{1-\gamma}{2}\,(1-a+1-l)\right)}_{\text{tax base factor }=1} \\ &= CF_t - TB_t \cdot \tau. \end{aligned} \tag{3}$$

The net cash flow NCF is reflected by the gross cash flow CF minus the tax payment. The tax payment is calculated by the tax base multiplied with the corporate tax rate τ and the tax base factor, which determines the tax-liable share of the group tax base. This share is, in case of a common formula, always equal to one.

In a two-period setting, I obtain the following future value of the net cash flows:

$$FV_2^{com} = \sum_{t=1}^{2}(CF_t - TB_t \cdot \tau) \cdot (1 + i(1-\tau))^{2-t}. \tag{4}$$

[8] This assumption is widely used in public economics. Cf. Niemann/Sureth, 2002, p. 1. For a study of tax effects on investment decisions under risk aversion and the involved methodological limitations see, for example, Niemann/Sureth, 2004, 2005.

The future value measures the nominal future sum of money that today`s net cash flow is worth at a specified time in the future assuming that it will be invested in the capital market at the pre-tax interest rate i.

3.2 Individual system

Under the individual system, under which both jurisdictions can set the factor weights individually, the share of the overall group tax base that is subject to taxation depends on the factor weights in each jurisdiction and the allocation of the factors among the group entities. The following example (see Tab. 1) clarifies how the variation in factor weights and the allocation of the factors among the entities determine the share of the tax-liable group tax base. I assume exemplarily that jurisdiction 1 applies a single-factor formula consisting only of the sales factor ($\gamma = 1$) and jurisdiction 2 the Massachusetts Formula ($\gamma = 1/3$).

	jurisdiction 1		jurisdiction 2	
Factor	**Weight**	**Share**	**Weight**	**Share**
Assets	0	0.7	1/3	0.3
Labor	0	0.3	1/3	0.7
Sales	1	0.8	1/3	0.2
Share subject to taxation	80%		40%	
Sum	120%			

Table 1: Example on how the interplay of factor weights and the allocation of the factors within the MJG determine the share of the tax-liable group tax base

In this example 120% of the group tax base is subject to taxation. Thus, the MJG has to pay more taxes under the individual system than under the common system. However, if the share of the sales factor amounts to 20% (instead of 80%) in jurisdiction 1 and to 80% (instead of 20%) in jurisdiction 2, then only 80% (instead of 120%) of the group tax base will be tax-liable. If, in the example as displayed in Tab. 1, jurisdiction 1 uses a single-factor formula consisting of labor instead of sales, then only 70% of the group tax base will be subject to taxation. In tendency, more than 100% of the group tax base is tax-liable if a major share of a factor is located in a jurisdiction that heavily weights this factor.

Experience gained in the US has shown that if jurisdictions deviate from the equally weighted Massachusetts Formula, they increase the weight of the sales factor and lower the weight of the remaining factors. Jurisdictions do so in order to promote economic development in their respective state. By increasing the weight of the sales factor and decreasing the weights of the labor and asset factor, the MJG is not "penalized" for investing in assets or hiring employees (cf. KPMG, 2012, p. 1, Multistate Tax Commission, 2003, p. 25). Many US states use the so called double-weighted sales formula, which weights the sales factor with 50% and the remaining two factors each with 25%. Other states weight the sales factor even higher and some states use it as the only determinant in a single-factor formula. In all US states the weight of the factor asset is equal to that of the labor factor.

Whereas on average the sales factor has the highest weight of the three formula factors in the US, it is not even part of the formula used in Germany to apportion the tax base of the trade tax. The German trade tax is apportioned according to a single-factor formula consisting of labor. In Canada a common formula consisting of the two factors labor and sales is applied. Both factors are weighted equally. In Switzerland, moreover, industry-specific formulas are used. Whereas, e.g. the formula for the manufacturing sector consists only of the factors capital and labor, the formula for the commerce sector contains only the sales factor. Thus, overall, it is apparent that, contrary to experience gained in the US, the sales factor is not the main driver for the tax base allocation under all worldwide existing formulary apportionment systems. Under formula apportionment systems in other countries the sales factor plays a rather minor or no role for the tax base allocation.

Since jurisdictions may change the factor weights, the weights are uncertain for future periods in both jurisdictions under the individual system. As a consequence of the uncertainty, future factor weights are likely to develop as a random walk with up- and downward movements. However, even if each jurisdiction can potentially change its factor weights in each period by any amount a fundamental change is rather unlikely. Experiences gained in the US show that the states have changed their factor weights in the past by increment. Arizona is an example of a state that slowly increased the weight on the sales factor. Originally, Arizona applied the equally-weighted Massachusetts-Formula. In 2009 it introduced a double-weighted sales formula and simultaneously offered an alternative formula consisting of a sales factor weighted by 80% and an asset and labor factors weighted by 10% each. Finally, in 2014, Arizona implemented a single-sales formula (cf. Tax Management BNA, 2014a, p.

8). The development of statutory tax rates in European countries suggests the same jurisdictional reform strategy as on the US state level. The European countries frequently adjust their statutory tax rates. Nevertheless, they adjust their rates only in small steps (cf. European Union, 2014, p. 37). Germany, e.g. in 1998, had a statutory tax rate on corporate proftis of 56%, which was decreased by about 4 percentage points in 1999 (cf. European Union, 2014, p. 37). In 2001 the rate was decreased further to a level of about 38%. Since the tax reform act in 2008 corporate profits are subject to an overall profit tax at a rate of about 30%. These US and European examples show that jurisdictions tend to implement rather small changes in tax systems. In line with this evidence, I assume small changes in the factor weights. These changes are captured by the constant Δ, which represents the average change in factor weights in both jurisdictions.

Factor weights are assumed to undergo discrete jumps in discrete time with a discrete state space. The annual upward or downward movement of the state variable sales factor weight γ by the constant Δ is characteristic of a binomial process. Thus, an additive binomial process seems to be adequate to catch uncertainty.[9] The factor weight at time $t = 1$ is

$\gamma + \Delta$ with probability p and

$\gamma - \Delta$ with probability $1 - p$.

To ensure that the factor weights vary only between zero and one the following condition must hold:

$$\gamma - T \cdot \Delta \geq 0 \ \wedge \ \gamma + T \cdot \Delta \leq 1.$$

T denotes the MJG's time horizon. For reasons of simplicity an immediate full loss offset is assumed. In my analysis, I distinguish between two different scenarios. In the first scenario, I assume that both jurisdictions set factor weights completely independent of each other. In the second scenario, it is assumed that the weights on the sales factor are perfectly negatively correlated between both jurisdictions. This implies that one jurisdiction decreases the weight of the sales factor if the other

[9] In principle, it would be also adequate to implement a multiplicative binomial process to generate the upward- and downward movement of the state variable. This approach would lead to similar results. However, in line with the approach used by Niemann (2004) and for reasons of comparison and a better intuitive understanding of the subject matter, I use an additive process.

jurisdiction increases it correspondingly. The object of research in this paper rules out an analysis of positively correlated factor weights as they preclude any tax base uncertainty. Disregarding perfectly positively correlated factor weights is supported by practical experience gained in the US: even decades after implementing the possibility to deviate from the Massachusetts Formula, the apportionment formulas still vary greatly between states (cf. Tax Management BNA, 2014, p. 8).

The deviations between factor weights within jurisdictions can be explained by game theory. In line with Anand and Sansing (2000), Weiner (2008a), and Mintz and Weiner (2008), jurisdictions' decisions on how to set factor weights can be interpreted as a game in which each jurisdiction tries to maximize its individual tax revenues. The literature stream examining game theory essentially provides two differing arguments explaining deviating factor weights between jurisdictions: the different industrial makeup of the states (cf. Anand and Sansing, 2000) and differing taxation goals, i.e., revenue maximizing or investment promoting strategies (cf. Weiner, 2008, p. 106).

First, against the trend in the last decades at the US state level, Anand and Sansing (2000) find that "the simple prediction that all states will have incentives to increase sales factor […] is generally wrong" since "states will […] have unilateral incentives to deviate from any […] coordinated solution". According to Anand and Sansing, the variation in different factor weights within jurisdictions results from unique underlying characteristics of the jurisdictions. They argue that the variations within factor weights in the US are explained by the different taxation objectives of the jurisdictions: some aim to tax immobile capital, such as natural resources and agriculture, while others prefer to tax mobile capital from manufacturing. The heterogeneity across states, with respect to natural resources, leads to different weighting strategies between the states: states exporting output from immobile capital tend to put less weight on the sales factor, while importing states tend to implement the opposite. Second, Lightner (1999) points out that jurisdictions have two conflicting goals when it comes to choosing factor weights. If the only aim of a jurisdiction is to increase tax revenues, it may increase the weights of the factors that are prevalent in that jurisdiction. Conversely, if a jurisdiction aims to attract new economic development it is well advised to reduce the weights on the decisive factors. Thus, each jurisdiction's differing economic aims and underlying physical characteristics may hinder them from aligning their factor weights

3.2.1 Uncorrelated factor weights between both jurisdictions

In the first scenario I assume that no jurisdiction takes the weighting decisions of the other jurisdiction into account. This assumption is in line with some empirical evidence found in the tax competition literature. A change in the weight of apportionment factors can be interpreted as a change in the effective corporate tax rate of the jurisdiction. Thus, allocation factor competition is a stylized form of tax competition. In an EU 15 setting, Ruiz and Gerard (2008) investigate the strategic interaction of the Member States with respect to effective tax rates. They find only limited evidence for strategic interactions. Furthermore, in a broader EU 27 setting, Overesch and Rincke (2011) cannot find evidence to support strategic interaction in effective tax rates. Both studies support the assumption that changes in factor weights, which represent a specific kind of changes in effective tax rates, do not affect factor weights in other jurisdictions.

Moreover, assuming uncorrelated factor weights is reasonable in specific industries, e.g. in the setting described previously by Anand and Sansing. In a two-jurisdiction setting, one jurisdiction is assumed to generate tax revenues mainly from taxing companies that process natural resources (e.g. agriculture, mining, forestry or fishery). Since companies that generate income by processing natural resources are highly unlikely to be able to shift their business to another more tax-advantageous jurisdiction, their home jurisdiction needs not fear that they will resettle; the other jurisdiction needs not to try to attract these companies. Thus, since behavioral adjustments of such companies can be practically ruled out, both jurisdictions set the weight of the factors independently of each other.

In a one-period setting there are four possible combinations for the different developments of sales factor weights in each jurisdiction. Either the weights are raised in both jurisdictions by the constant Δ with the probability p, or they are reduced by both jurisdictions with the probability $(1-p)$, or they are raised by one jurisdiction and reduced by the other one. Here, the constant Δ can be interpreted as the magnitude of the factor weight uncertainty.

In a one period setting, the expected after-tax net cash flow under the individual system is – independent of the probability p – equal to the after-tax net cash flow under the common system. When calculating the expected after-tax net cash flow under the individual system, the four different combinations of factor weight developments add up to zero. In a two-period setting the combination of the binomial trees and the resulting possible future weight developments in jurisdiction 1 and 2 are exemplified for the sales factor in Fig. 1. Since in this scenario the jurisdictions set the factor weights independently of each other, there is no correlation between the binomial trees of jurisdiction 1 and 2. The binomial process of the factor weights in each jurisdiction begins with a sales factor weight of γ.

[Insert Figure 1 about here]

Since I consider changes in the factor weights in annual intervals and since the magnitude of the changes is constant (Δ), the branches of the binomial trees always recombine. Each binomial tree shows four different weighting developments that result in three final states. For my analysis the weighting developments are crucial. Thus, there are 4 x 4 (=16) different combinations of factor weighting developments in jurisdiction 1 and 2 in two periods.

In order to determine the expected future value for the weighting developments illustrated in Fig. 1 the future value of each branch has to be calculated by considering the probability p. For demonstration purposes the following model shows exemplarily the determination of the future value for a specific path, taking into account the probability p. The path is characterized by a raise in the sales factor weight in jurisdiction 1 and a reduction in jurisdiction 2 for the first period, followed by a reduction in both jurisdictions in the second period.

$$FV_2^{ind_{example}} = [CF_1$$

$$\underbrace{-TB_1 \cdot \tau \left((\gamma + p\,\Delta)\, s + \left(\tfrac{1-\gamma}{2} - p\,\tfrac{\Delta}{2}\right)(a+l) + (\gamma - (1-p)\,\Delta)\,(1-s) + \left(\tfrac{1-\gamma}{2} + (1-p)\tfrac{\Delta}{2}\right)(1-a+1-l)\right)]}_{\text{tax payments in t=1}}$$

$$\underbrace{\cdot \left[1 + i\left(1 - \tau\left(\gamma \cdot s + \tfrac{1-\gamma}{2}\,(a+l) + (\gamma - 2\,(1-p)^2\,\Delta)\,(1-s) + \left(\tfrac{1-\gamma}{2} + (1-p)^2\,\Delta\right)(1-a+1-l)\right)\right)\right]}_{\text{after-tax interest rate in t=2}}$$

$$\underbrace{+CF_2 - TB_2 \cdot \tau\left(\gamma \cdot s + \tfrac{1-\gamma}{2}(a+l) + (\gamma - 2\,(1-p)^2\,\Delta)\,(1-s) + \left(\tfrac{1-\gamma}{2} + (1-p)^2\,\Delta\right)(1-a+1-l)\right).}_{\text{after-tax cash flow in t=2}} \tag{5}$$

The first three lines of eq. (5) display the compounded first periods' net cash flow. It becomes clear that the factor weights of the second period also determine the share of the interest payment that is subject to taxation. The last line of eq. (5) displays the share of the group tax base that is tax-liable in the second period.

By transforming and summarizing the formulas for all 16 branches, I obtain the following equation for the expected future value under the individual system after two periods.

$$E\left[FV_2^{ind_{uncorr}}\right] = (CF_1 - TB_1 \cdot \tau)\,\left(1 + i(1-\tau)\right) + \underbrace{TB_1 \cdot \tau^2 \cdot \Delta^2 \cdot i\left(s - \tfrac{1}{2}\,(a+l)\right)^2 \cdot \left(\tfrac{1}{2} - p + p^2\right)}_{\text{uncertainty term}}$$
$$+CF_2 - TB_2 \cdot \tau. \tag{6}$$

In eq. (6), the expected future value is a function of the factor weight uncertainty captured by the constant Δ. As becomes apparent in eq. (5), each of the 16 future values represented by the branches of the binomial tree is calculated by multiplying each net cash flow of the first period with the corresponding after-tax interest rates of the second period. The weighting developments of the second period also determine the after-tax interest rate, since interest payments are taxed similar to regular business income.

In the second period, some of the weighting developments cannot occur anymore, as they are already ruled out by the developments in the first period. Consequently, developments in the first period predetermine, to some extent, those of the second period. This implies that, for example, high first periods' after-tax net cash flows (due to low tax payments) tend to be multiplied with high after-tax interest rates in the second period. The opposite is true for low first periods' after-tax net cash flows. Thus, the interest effect increases the differences in the after-tax net cash flows of the first period to a different degree. Owing to this interplay between the low/high first period's after-tax cash flows and the low/high second period's after-tax interest rates, the net cash flows of the 16 weighting developments no longer completely cancel each other out. In essence, the high first period's after-tax cash flows multiplied with the high second period's after-tax interest rates overcompensate the low first period's after-tax cash flows multiplied with the low second period's after-tax interest rates and hence they do not add up to zero. In this two-jurisdiction, two-entity-setting, six out of 16 branches do not vanish, thus determine the uncertainty term. Without interest effects, the (expected) future value under the individual system would be similar to that under the common system.

The impact of the factor weight uncertainty depends on the tax rate τ, the interest rate i, the allocation of the factors a, l and s, the probability p and on the tax base TB_1 in the first period. Note that the impact of the factor weight uncertainty does not depend on the value of the (initial) weight of the sales factor γ. The particular design of the (initial) apportionment formula is not decisive in this setting as tax rate differentials have not been taken into account. For determining the expected tax-liable share of the group tax base under the individual system, it is only the potential deviations in the design of apportionment formulas between both jurisdictions which matter. Since the tax rate τ, the interest rate i and the probability p take on values between 0 and 1 these factors cannot negatively impact the uncertainty term. However, their magnitude determines the level of the impact of the factor weight uncertainty on the expected future value. The higher the tax and interest rates and the more the probability p deviates from 0.5, the higher the impact of the factor weight uncertainty on the expected future value.

In case of a positive/negative first periods' tax base the uncertainty impacts the expected future value positively/negatively. A positive (negative) tax base of the first period leads to a positive (negative) impact of the factor weight uncertainty on the expected future value. The impact of the factor weight uncertainty depends also on the allocation of the factors a, l and s between the two jurisdictions. The more unequal the share of the sales factor s on the one hand and the sum of the labor l and asset a factors on the other hand are distributed within each jurisdiction, the higher the impact of the factor weight uncertainty on the expected future value. Thus, the impact of the factor weight uncertainty is at its peak when the share of the sales factor s is one, and the sum of the factors asset a and labor l is zero in one of the two jurisdictions ($s = 1$ and $a + l = 0$ or $s = 0$ and $a + l = 1$). If the sum of the factors asset a and labor l is equal to the share of the sales factor s ($a + l = s$) in each jurisdiction, then the uncertainty term becomes zero and factor weight uncertainty does not affect the expected future value. In this case, the (expected) future value under the individual system is similar to that under the common system.

3.2.2 Negatively correlated factor weights between jurisdictions

In line with the argumentation of Lightner (1999), it is also conceivable that factor weights between jurisdictions are perfectly negatively correlated (factor -1). Jurisdictions that focus on generating tax revenues from the same kind of immobile capital, such as manufacturing, may have opposing weighting strategies. While one jurisdiction may aim to heavily tax the prevalent companies by setting high weights on the asset and labor factor, the other jurisdiction may want to attract new economic development by setting extra low weights on the asset and labor factor.[10] Furthermore, jurisdictions may want to differentiate from each other in order to exploit more exclusive taxing niches.

Another reason for negatively correlated factor weights can be found in the general tax competition literature. As a change in factor weights can be reinterpreted as a change in effective corporate tax

[10] Goolsbee/Maydew, 2000, find that a reduction in the payroll factor weight from one third to one quarter increases manufacturing employment around 1,1%.

rates (see Section 3.2.1), it is reasonable to refer to this literature stream. Gordon (1992), Bucovetsky (1991) and Wilson (1991) model tax competition between countries that are unequal in size. Bucovetsky and Wilson conclude that smaller countries set lower tax rates, while Gordon, in turn, concludes that large countries set higher tax rates. Both papers together support my assumption of negatively correlated effective tax rates between jurisdictions, as illustrated here by the example of large and small countries.

Fig. 2 shows the combination of the possible weighting developments for opposing weighting strategies of the jurisdictions. Since in this scenario the weighting decisions of both jurisdictions are correlated by the factor (-1), the factor weights in jurisdiction 2 are dependent on that in jurisdiction 1 for each period. In order to indicate the relation between the weight setting developments of jurisdiction 1 and 2, I use different types of lines for the binomial trees in the following figure. The weighting developments in jurisdiction 2 must follow the same pattern of lines as the weighting developments in jurisdiction 1 over time. Because of the correlation between the weighting processes of both jurisdictions the number of possible combinations of future factor weight developments has decreased to four (compared to 16 in case of uncorrelated factor weights). The thin grey lines of the binomial trees in jurisdiction 2 indicate that these branches of the trees are irrelevant for the analysis in this section.

[Insert Figure 2 about here]

By transforming and summarizing the formulas for the after-tax future value of the four possible weighting developments, the following model for the expected after-tax future value is obtained:

$$E\left[FV_2^{ind_{corr:-1}}\right] = (CF_1 - TB_1 \cdot \tau) \cdot \left(1 + i(1-\tau)\right) + \underbrace{2\,TB_1 \cdot \tau^2 \cdot \Delta^2 \cdot i\left(s - \frac{1}{2} * (a+l)\right)^2 \cdot \left(\frac{1}{2} - p + p^2\right)}_{\text{uncertainty term}}$$
$$+CF_2 - TB_2 \cdot \tau. \qquad (7)$$

In line with the explanation given in Section 3.2.1, the uncertainty term results from some branches of the binomial tree that do not cancel each other out. Compared to non-correlated factor weights the number of different combinations for weighting developments decreases but the relative share of combinations that do not add up to zero anymore increases. Here, two out of four branches do not cancel each other out.

By comparing this model of perfectly negatively correlated factor weights with the model for non-correlated factor weights, it becomes apparent that both models are, to a large extent, identical. The only difference is that the uncertainty term in eq. (7) is multiplied by the factor of 2. Thus, the effects explained above hold also true for the model of perfectly negatively correlated factor weights, but the impact of the uncertainty on the expected future value of after-tax cash flows is twice as large.

4 Results

By assuming a risk neutral investment decision-maker of the MJG, I can directly compare the (expected) future values under both the individual and the common system (eq. (4) and eq. (6)/eq. (7)). The future value under the common system serves as a benchmark for the expected future values under the individual system.

The difference in the models for the (expected) future value under both systems (eq. (6)/eq. (7)) is the term containing the uncertainty. As described in Section 3.2, only the tax base of the first period determines whether the factor weight uncertainty has a positive or negative impact on the expected future value under the individual system. If the tax base has a positive (negative) sign, the expected future value under the individual system is higher (lower) than the future value under the individual system. Moreover, the absolute difference in (expected) future values under both systems increases with rising factor weight uncertainty Δ. These results contradict the rather popular view that tax uncertainty generally depresses MJG's expectations about future after-tax income. Under certain conditions, the analysis shows that the opposite is true: higher tax uncertainty may even increase expectations. The paradoxical tax effects result from the uncertainty itself, and not, as one may assume, purely from cases in which undertaxation occurs.[11]

Furthermore, the analysis reveals that the (expected) future values under the individual system are at least as high (low) as that under the common system in case of a positive (negative) tax base of the

[11] Paradoxical effects solely resulting from uncertainty are also found by Gries et al., 2012.

first period, irrespective of the allocation of the factors sales s, labor l and assets a between the group entities. However, the allocation of these factors within the MJG determines the degree of how much the (expected) future value under the individual system is higher/lower than that under the common system. In case the factors assets a, labor l and sales s are allocated among the group in a way that the following relation holds true $s = a = l$, the (expected) future values under both systems become equal. The difference in (expected) future values between both systems is maximized if either the sum of the asset and labor factors is equal to one ($a + l = 1$) and the sales factor s is equal to zero ($s = 0$) or vice versa.

The distinction between uncorrelated and perfectly negatively correlated factor weights shows that the relation of weighting strategies between jurisdictions impacts the level by which the uncertainty affects the expected future income. If the factor weighting process between the jurisdictions is perfectly negatively correlated, then the impact of the uncertainty on the expected future value is twice as high as if the factor weights were uncorrelated. Thus, perfectly negatively correlated weighting strategies result in either higher positive or higher negative differences in (expected) future values between the common and the individual system.

The analysis shows that the positive/negative difference between the (expected) future values under the individual and the common system increase with an increasing corporate tax rate τ and interest rate i. Moreover, the analysis reveals that the impact of uncertainty on the expected future value increases if the probability p for an upward movement of the factor weight deviates more from 0.5. A practical example for jurisdictions that tend to have deviating probabilities from $p = 0.5$ are the states in the US: experience shows that US states tend to increase the weight of the sales factor over time. Thus, on average, the probability p for an increase in sales factor weights by US states is considerably larger than 0.5. The impact of the probability p on the uncertainty term is always positive. Consequently, the probability p cannot lead to a change in sign of the uncertainty term.

As already outlined in the analysis of the individual system, results are mainly driven by after-tax interest effects. The applicable after-tax interest rates that are used to compound the cash flows are path-dependent as the factor weights also drive the tax burden on interest income. As a consequence the after-tax net cash flows compounded to the second period for all possible weighting developments may not recombine. As a result of factor weights chosen in the underlying jurisdictions, some branches of the binomial tree do not cancel each other out when calculating the future value for each weighting development. In tendency, under the individual system, high/low after-tax cash flows are compounded with high/low after-tax interest rates. Thus, the assumption of constant weight changes over time drives my results to some extent since these weights determine the magnitude of the after-tax cash flows and the after-tax interest effects and create asymmetric outcomes in the second period. Consequently, the question rises if the results hold also true in a setting with asymmetric binomial trees.

I checked the validity of my results in a robustness test. Therefore, the binomial trees are assumed to be skewed similarly in both jurisdictions. I skewed the random walks, e.g., by setting the highest possible factor weight on the sales factor up to $\gamma + 3\Delta$ (instead of $\gamma + 2\Delta$) in the second period leaving the downward movement unchanged. I find that my results still generally hold in this setting. The impact of the uncertainty on the expected after-tax future income under the individual system becomes even stronger the more skewed the decision trees are. This result holds regardless of whether the decision tree is skewed in a positive or negative direction. In a further robustness test, I assume that the factor weights may not necessarily change on a periodical basis but may also remain on their current level. Also in this setting, the basic results hold true but, however, the impact of the uncertainty on the expected after-tax cash flows is mitigated. All in all, the robustness tests clarify that the identified effects are not restricted to settings with symmetric binomial trees. Irrespective of the characteristics of the random walk I find that uncertainty impacts the expected after-tax income positively or negatively. However, the magnitude of the impact of uncertainty on the after-tax income increases with increased skewness of the binomial tree.

5 Conclusion

In this paper, I examine if the uncertainty implied by individually-set factor weights by jurisdictions decreases the expectations about future income of an MJG. I compare the (expected) after-tax future income of an MJG under a system where all jurisdictions are bound to use exactly the same formula (common system) with a system that allows each jurisdiction to determine the weights on the apportionment factors individually (individual system). Whereas under a common system always exact 100% of the group tax base is subject to taxation, it may be more or less than this under the individual system. The tax-liable share of the group tax base depends on the combination of factor weights in each jurisdiction and the allocation of the factors within the MJG. Since jurisdictions are free to change the factor weights at any time, the individual system contains uncertainty about the future tax-liable share of the group tax base and thus also about the future after-tax income.

I use a two-jurisdictions-two-entities setting and assume that the tax rates in both jurisdictions are equal. The results clarify that factor weight uncertainty affects MJGs expectations about the after-tax future income in an ambiguous manner. Counterintuitively, the results show that in case of a positive first period's tax base the (expected) after-tax income under the individual system is higher than that under the common system. In case of a negative first period's tax base the opposite is true. Thus, the factor weight uncertainty affects the expected future income negatively for companies that are likely to incur initial losses (as start-up firms typically do) and positively for economically successful, profit-making companies. Furthermore, I find that the expected future values increase under the individual system with increasing factor weight uncertainty in case of a positive first periods' tax base. Thus, the results are contrary to the popular view that uncertainty reduces expectations about future after-tax income. Moreover, the results show that regardless of how the factors assets, labor and sales are allocated between the group entities, they cannot influence the uncertainty term negatively. The same is true for the tax rate τ, the interest rate i and the probability p by which the sales factor weights are raised. However, they determine the degree by which the (expected) future values under both systems differ. Furthermore, the relation of the weighting strategies between the jurisdictions determines how strong the impact of the uncertainty is on the expected future income: the impact in case of perfectly negatively correlated weighting strategies is twice as high as that of uncorrelated strategies.

I contribute to the existing literature on regulatory risk and tax risk through a theoretical framework that deals with the effects arising from tax uncertainty in interjurisdictional settings. I identify two rather surprising results. First, tax base uncertainty (here implied by the application of the individual system) does not necessarily dampen MJGs' expectations about its future income and thus may not discourage investments. Second, more uncertainty may result in even higher expectations concerning future income.

The results are helpful for policy makers debating the concrete design of a formulary apportionment system as well as for MJGs in jurisdictions where the implementation of an individual system is being considered. It is demonstrated that uncertainty implied by an individual system may not dampen MJGs' expectations about future income and thus may not slow down the economy in jurisdictions. Specifically, the results could be useful in a CCCTB context. If the Member States continue to fail to reach agreement on the implementation of a CCCTB, individually determined factor weights by each jurisdiction may re-enter the agenda.

The results of this analysis may also be helpful in assessing the consequences from other sources of tax base uncertainty, especially within a CCCTB context. Some research analyzes the effects of legal loopholes or questions regarding the interpretation and implementation of the proposed CCCTB system. However, contrary to my study, these studies use specific elements of tax base uncertainty to motivate their research question but do not investigate tax uncertainty in particular. Eberhartinger and Petutschnig (2014) focus on the unclear definition of the term "employee" which is a factor of the apportionment formula under the proposed CCCTB system. Kiesewetter et al. (2014), in their analysis, consider room for discretion concerning the apportionment factor "assets". Both studies address a specific form of factor uncertainty. In this context my results could, to some extent, also be helpful for discussing implications of other sources of factor uncertainty.

When interpreting the results, one has to bear in mind the following two limitations. First, even if widely in line with empirical evidence (Weiner (1994), (1999), Lightner (1999)), behavioral adjustments by rational MJGs when faced with changing factor weights are excluded. The expected after-tax future value under the individual system would increase if behavioral adjustments were accounted for. Thus, the results are likely biased towards the disadvantage of the individual system. Second, I assume risk neutral decision-makers of MJGs. Assuming risk aversion would favor the common system, since the MJG decision-maker would demand an additional risk premium for applying the individual system.

References

Agliardi, Elettra (2001): Taxation and Investment Decisions: A Real Option Approach. In: Australian Economic Papers, Vol. 40, No. 1 (2001), pp. 44-55.

Alm, James (1988): Uncertain Tax Policies, Individual Behavior, and Welfare. In: American Economic Review, Vol. 78, No. 1 (1988), pp. 237-245.

Alvarez, Luis H. R./Koskela, Erkki (2008): Progressive Taxation, Tax Exemption, and Irreversible Investment under Uncertainty. In: Journal of Public Economic Theory, Vol. 10, No. 1 (2008), pp. 149-169.

Alvarez, Luis H. R./Kanniainen, Vesa/Södersten, Jan (1998): Tax policy uncertainty and corporate investment: A theory of tax-induced investment spurts. In: Journal of Public Economics, Vol. 69, No. 1 (1998), pp. 17-48.

Anand, Bharat N./Sansing, Richard (2000): The Weighting Game: Formula Apportionment as an Instrument of Public Policy. In: National Tax Journal, Vol. 53, No. 2 (2000), pp. 183-200.

Auerbach, Alan J./Hines, James R. (1988): Investment Tax Incentives and Frequent Tax Reforms. In: American Economic Review, Papers & Proceedings, Vol. 78, No. 2 (1988), pp. 211-216.

Bloom, Nicholas/Kose, Ayhan M./Terrones, Marco E. (2013): Held Back by Uncertainty. In: Finance and Development, Vol. 50, No. 1 (2013), pp. 38-41.

Bloom, Nicholas/ Bond, Stephen/Van Reenen, John (2007): Uncertainty and Investment Dynamics. In: Review of Economic Studies, Vol. 74, No. 2 (2007), pp. 391-415.

Blouin, Jennifer L./Devereux, Michael/Shackelford, Douglas A. (2012): Investment, tax uncertainty and aggressive tax avoidance. University of Pennsylvania, Oxford University and University of North Carolina working paper.

Bucovetsky, Sam (1991): Asymmetric Tax Competition. In: Journal of Urban Economics, Vol. 30, No. 2 (1991), pp. 167-181.

CCCTB Working Group (2007): CCCTB: Possible Elements of the Sharing Mechanism. CCCTB/WP060\doc\en, Brussels.

Center for Tax Policy and Administration, OECD (2010): Review of Comparability and of Profit Methods: Revision of Chapter I – III of the Transfer Pricing Guidelines.

Eberhartinger, Eva/Petutschnig, Matthias (2014): CCCTB-The Employment Factor Game. WU International Taxation Research Paper Series No. 2014 – 01.

Edmiston, K.D. (2002): Strategic Apportionment of the State Corporate Income Tax. An Applied General Equilibrium Analysis. In: Journal of the American Accounting Association, Vol. 60, No. 2 (2002), pp. 239-262.

Edmiston, K.D. (2004): Tax Uncertainty and Investment: A Cross-Country Empirical Examination. In: Economic Inquiry, Vol. 42, No. 3 (2004), pp. 425-440.

European Commission (2011): Proposal for a Council Directive on a Common Consolidated Corporate Tax Base. COM (2011) 121/4, Brussels.

European Economic and Social Committee (2011): Opinion of the European Economic and Social Committee on the "Proposal for a Council directive on a Common Consolidated Corporate Tax Base (CCCTB)". ces1585-2011_ac_en.doc, Brussels.

European Union (2014): Taxation Trends in the European Union, Luxembourg.

Gérard, Marcel/Princen, Savina (2012): Investment and Financing Strategy of a Multinational Enterprise under Alternative Tax Designs. CESifo Working Paper No. 3838, Munich.

Goolsbee, Austan/Maydew, Edward L. (2000): Coveting they neighbor`s manufacturing: The dilemma of state income apportionment. In: Journal of Public Economics, Vol. 75, No. 1 (2000), pp. 125-143.

Gordon, Roger/Wilson, John D. (1986): An Examination of Multijurisdictional Corporate Income Taxation under Formula Apportionment. In: Econometrica, Vol. 54, No. 6 (1986), pp. 1357-1373.

Gordon, Roger (1992): Can Capital Income Taxes Survive in Open Economies? In: The Journal of Finance, Vol. 47, No. 3 (1992), pp. 1159-1180.

Gries, Thomas/Prior, Ulrich/Sureth, Caren (2012): A Tax Paradox for Investment Decisions under Uncertainty. In: Journal of Public Economic Theory, Vol. 14, No. 3 (2012), pp. 521-545.

Gupta, Sonjay/Hofmann, Mary A. (2003): The Effect of State Income Tax Apportionment and Tax Incentives on New Capital Expenditures. In: The Journal of the American Taxation Association, Vol. 25, Supplement (2003), pp. 1-25.

IHK, Industrie-und Handelskammer (2013): Unsicherheit bleibt Hemmnis für Konjunkturschub, 2 Oct. 2013. Web. 27 Nov. 2013. http://www.pfalz.ihk24.de/servicemarken/Presse-_und_Oeffentlichkeitsarbeit/Pressemitteilungen_-_aktuell/2591586/Unsicherheit_bleibt_Hemmnis_fuer_Konjunkturschub.html.

Kiesewetter, Dirk/Steigenberger, Tobias/Stier, Matthias (2014): Can Formula Apportionment Really Prevent Multinational Enterprises From Profit Shifting? – The Role of Asset Valuation, Intra-group Debt and Leases. arqus Discussion Paper No. 175.

KPMG (2012): The KPMG Guide to CCCTB – Part III.

Kelly, James (2001): The Role of the Personnel/HR Function in Multinational Companies. In: Employee Relations, Vol. 23, No. 6 (2001), pp. 536-557.

Lightner, Teresa (1999): The Effects of the Formulary Apportionment System on State-Level Economic Development and Multijurisdictional Tax Planning. In: Journal of the American Accounting Association, Vol. 21, Supplement (1999), pp. 42-57.

MacKie-Mason, Jeffrey (1990): Do Taxes Affect Corporate Financing Decisions? In: The Journal of Finance, Vol. 45, No. 5 (1990), pp. 1471-1493.

Martini, Jan T./Niemann, Rainer/Simons, Dirk (2012): Transfer Pricing or Formula Apportionment? Tax-induced Distortions of Multinationals´ Investment and Production Decisions. In: Contemporary Accounting Research, Vol. 29, No. 4 (2012), pp. 1060-1086.

McLure, Charles (1980): The State Corporate Income Tax: Lambs in Wolves' Clothing. In: Aaron, Henry/Boskin, Michael (Ed.), The Economics of Taxation, Washington.

Misik, Robert: Unsicherheit treibt uns nicht an, sie lähmt uns – eine tägliche Dosis Gift, 31 July 2012. Web. 27 Nov. 2013. http://www.taz.de/!98356/.

Mintz, Jack/Weiner, Joann M. (2008): Some Open Negotiation Issues Involving a Common Consolidated Corporate Tax Base in the European Union. In: Tax Law Review, Vol. 62, No. 1 (2008), pp. 81-118.

Multistate Tax Commission (2003): Federalism at risk- A Report of the Multistate Tax Commission. Washington, DC.

Nielsen, Søren B./Raimondos-Møller, Pascalis/Schjelderup, Guttorm (2010). Company Taxation and Tax Spillovers: Separate Accounting versus Formula Apportionment. In: European Economic Review, Vol. 54, No. 1 (2010), pp. 121-132.

Niemann, Rainer (2004): Tax Rate Uncertainty, Investment Decisions, and Tax Neutrality. In: International Tax and Public Finance, Vol. 11, No. 3 (2004), pp. 265-281.

Niemann, Rainer (2011): The Impact of Tax Uncertainty on Irreversible Investment. In: Review of Managerial Science, Vol. 5, No. 1 (2011), pp. 1-17.

Niemann, Rainer/Sureth, Caren (2002): Taxation under uncertainty – problems of dynamic programming and contingent claims analysis in real option theory. CESifo, Center for Economic Studies and Ifo Institute, Working Paper No. 709, Munich and SSRN Working Paper No. 312131.

Niemann, Rainer/Sureth, Caren (2004): Tax Neutrality under Irreversibility and Risk Aversion. In: Economics Letters, Vol. 84, No. 1 (2004), pp. 43-47.

Niemann, Rainer/Sureth, Caren (2005): Capital Budgeting with Taxes under Uncertainty and Irreversibility. In: Journal of Economics and Statistics, Vol. 225, No. 1 (2005), pp. 77-95.

OECD (2013): OECD International Direct Investment Statistics 2013. OECD Publishing.

Overesch, Michael/Rincke, Johannes (2011): What Drives Corprate Tax Rates Down? A Reassessment of Globalization, Tax Competition and Dynamic Adjustments to Shocks. In: Scandinavian Journal of Economics, Vol. 113, No. 3 (2011), pp. 579-602.

Panteghini, Paolo M./Scarpa, Carlo (2003): Irreversible Investment and Regulatory Risk. CESifo Working Paper No. 934, Munich.

Pawlina, Grzegorz/Kort, Peter M. (2005): Investment under uncertainty and policy change. In: Journal of Economic Dynamics and Control, Vol. 29, No. 7 (2005), pp. 1193-1209.

Ruiz, Fernando. M. M./Gérard, Marcel (2008): Is There Evidence of Strategic Corporate Tax Interaction among EU Countries? Munich Personal RePEc Archive Paper No. 10094.

Skinner, Jonathan (1988): The Welfare Cost of Uncertain Tax Policy. In: Journal of Public Economics, Vol. 37, No. 2 (1988), pp. 129-145.

Stomberg, Bridget M. (2013): Tax Uncertainty and Real Investment Decisions: Evidence from Mergers and Acquisitions. Austin.

Sureth, Caren (2002): Partially irreversible investment decisions and taxation under uncertainty – a real option approach. In: German Economic Review, Vol. 3, No. 2 (2002), pp. 185-221.

Tax Management BNA (2014): USA – Corporate Taxation. IBFD Publications, Amsterdam.

Tax Management BNA (2014a): USA – Arizona – Corporate Taxation. IBFD Publications, Amsterdam.

UNCTAD (2013): World Investment Report 2013. New York and Geneva.

Weiner, Joann M. (1994): Company Taxation for the European Community. How Sub-National Tax Variation Affects Business Investment in the United States and Canada. PhD diss, Harvard University, Cambridge, USA.

Weiner, Joann M. (1999): Using the Experience in the US States to Evaluate Issues in Implementing Formula Apportionment at the International Level. Office of Tax Analysis OTA Paper 83.

Weiner, Joann M. (2005): Formulary Apportionment and Group Taxation In the European Union: Insights from the United States and Canada. European Commission Working Paper No. 8/2005.

Weiner, Joann M. (2008): Tackling Business Tax Reform in the U.S. and EU. In: Tax Notes International, Vol. 49, No. 6 (2008), pp. 16-18.

Weiner, Joann M. (2008a): Formula One. The race to find a common formula to apportion the EU tax base. In: EC Tax Review, Vol. 17, No. 3 (2008a), pp. 100-110.

Weiner, Joann M. (2008b): Aujean Maintains Support for CCCTB. In: Tax Notes International, Vol. 52, No. 1 (2008b), pp. 15-16.

Wilson, John D. (1991): Tax Competition with Interregional differences in Factor Endowments. In: Regional Science and Urban Economics, Vol. 21, No. 3 (1991), pp. 423-451.

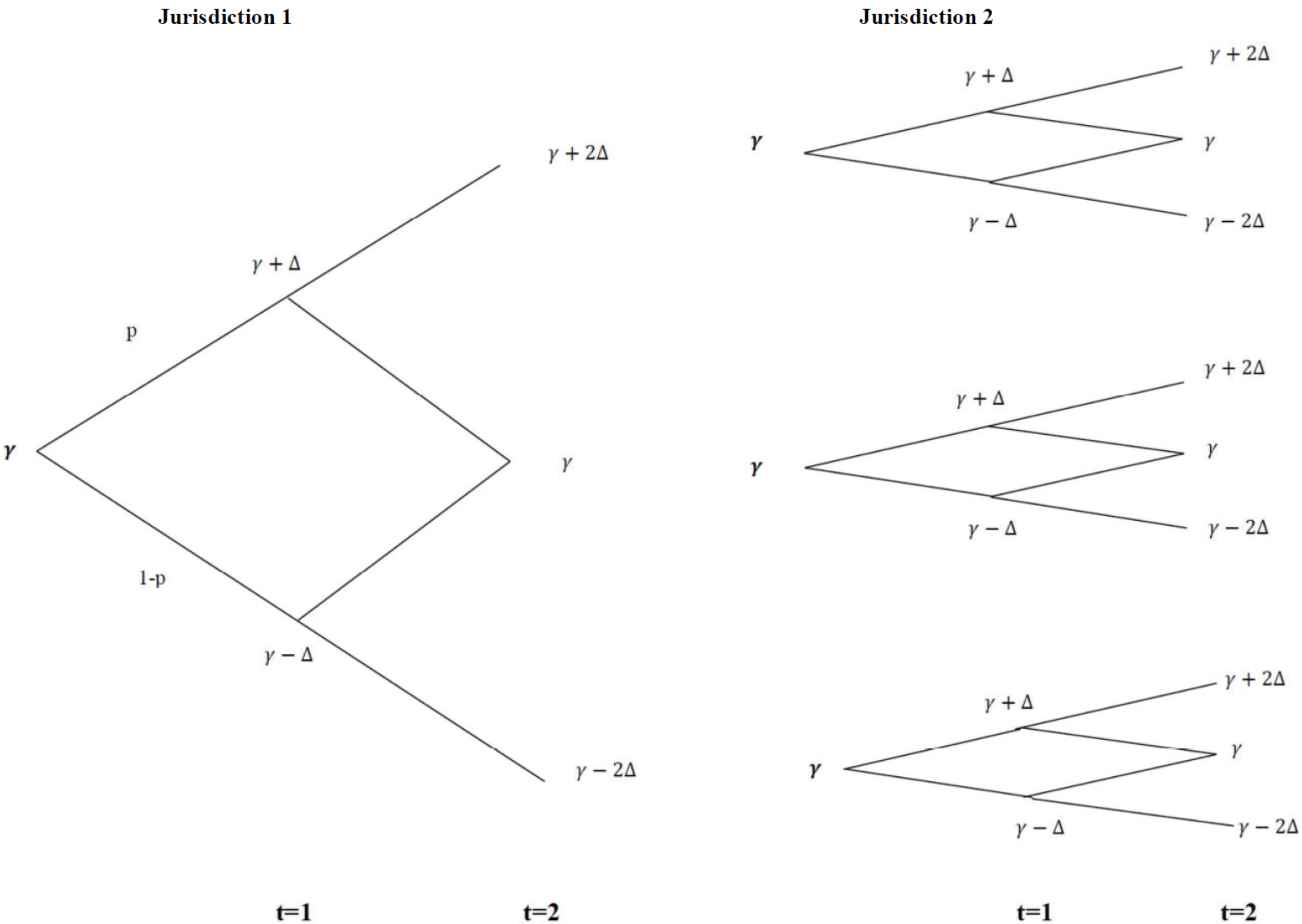
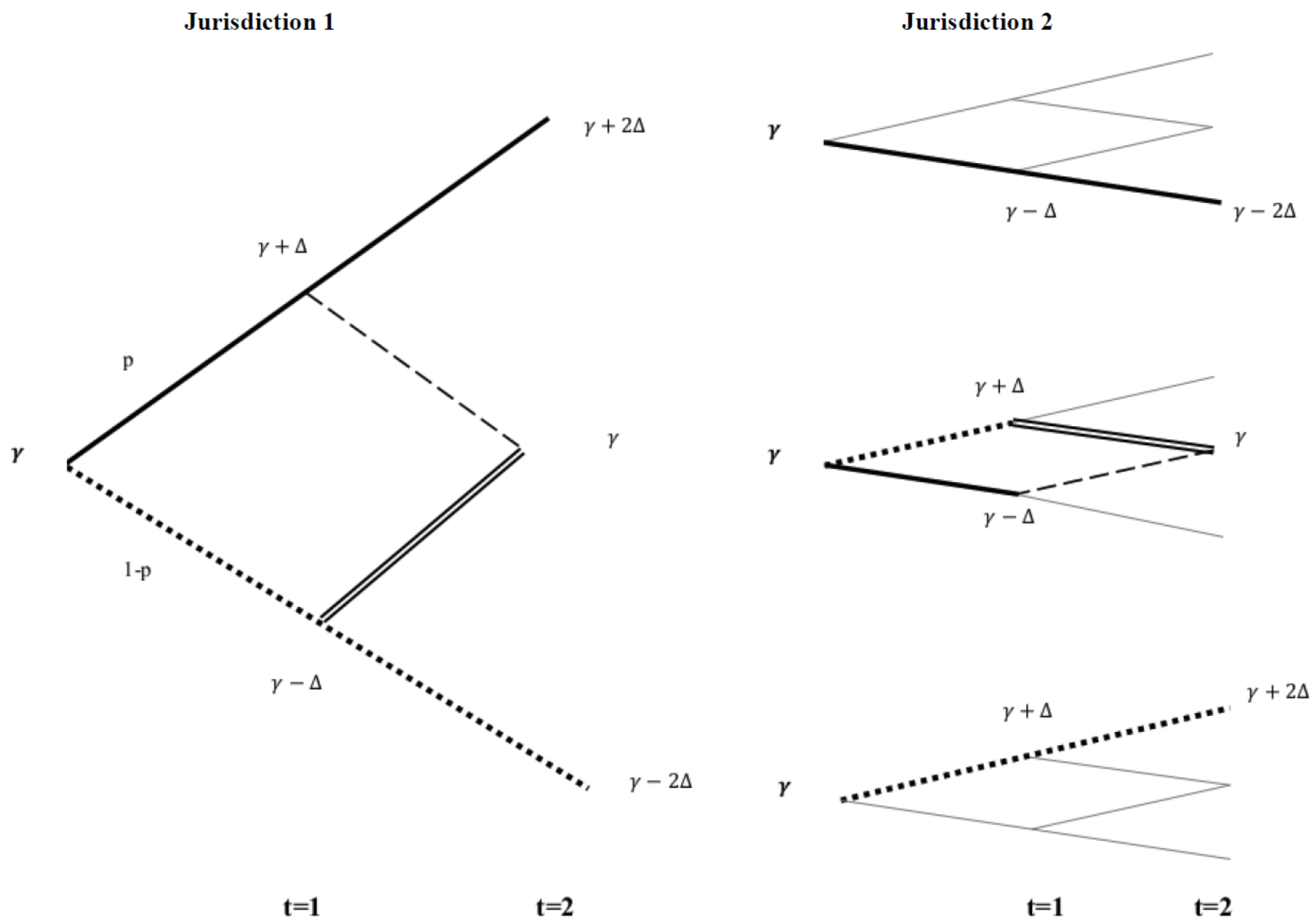


Fig. 1: Possible combinations of weighting developments in jurisdiction 1 and 2 for the sales factor weight (two-period setting, uncorrelated factor weights



Notes: Since the developments of factor weights in both jurisdictions are perfectly negatively correlated, the factor weight development in jurisdiction 2 is a function of the factor weights in jurisdiction 1. The different types of lines indicate the development of factor weights in jurisdiction 2 given the development in jurisdiction 1. The developments in both jurisdictions must follow the same patterns of lines. E.g., if the factor weights in jurisdiction 1 are chosen in line with the dotted line, the corresponding weights in jurisdiction 2 are illustrated by a dotted line, too. If the factor weights in jurisdiction 1 are chosen according to the path described by the solid line (first branch) and the dashed line (second branch) then the resulting weights in jurisdiction 2 are correspondingly illustrated by the solid and dashed branches.

Fig. 2: Possible combinations of weighting developments in jurisdiction 1 and 2 for the sales factor weight (two-period setting, perfectly negatively correlated factor weights)

Paper 3:

Formula Apportionment or Separate Accounting? Tax-Induced Distortions of Multinationals' Locational Investment Decisions

Regina Ortmann and Erich Pummerer

Formula Apportionment or Separate Accounting? Tax-Induced Distortions of Multinationals' Locational Investment Decisions

Regina Ortmann, *University of Paderborn* and *Vienna University of Economics and Business*

Erich Pummerer, *University of Innsbruck*

Abstract

We examine which tax allocation system leads to more severe distortions with respect to locational investment decisions. We consider separate accounting (SA) and formula apportionment (FA). The effects of both systems have been hotly debated in Europe in the past years. The reason is that the EU Member States are striving to implement a common European tax system that would lead to a switch from SA to FA. While existing studies focus primarily on the impact of taxes on locational decisions under either SA or FA, the main innovation of this paper is that it compares both systems with regard to the level of distortions they induce. We compare the optimal pre-tax investment decision with the optimal after-tax investment decision and infer from the difference in the allocation of investment funds which tax allocation system causes more severe distortions. We assume that the multinational group (MNG) has comprehensive book income shifting opportunities under SA. We find that the investment incentives under SA are opposed to those under FA for a profitable investment project. Whereas under SA as much as possible should be invested in a high-tax country, under FA as much as possible should be invested in a low-tax country. The distortions of locational investment decisions tend to be more severe under SA than under FA if a greater share of investment funds is to be invested in a low-tax country from a pre-tax perspective and the investment is profitable. Vice versa, locational decisions may be more distorted under FA if the optimal pre-tax investment decision requires investing a major share of funds in the high-tax country. In contrast to the often stated insensitivity of FA towards income shifting, we find the introduction of a tax allocation system based on FA in Europe could lead to a severe shift of economic substance to low-tax countries. The results of this paper are of particular interest for European policy makers and MNGs as our findings may induce European MNGs to reassess their recent locational investment decisions in the face of a potential future change in the applied tax allocation system.

Acknowledgments

We would like to thank Tobias Bornemann, Eva Eberhartinger, Fabian Failenschmid, Thomas Hoppe, Lillian Mills, Richard Sansing, Caren Sureth-Sloane, the participants of the Poster Session of the ATA Midyear Meeting 2015 in Washington DC, the members of the DIBT Doctoral Program in International Business Taxation at Vienna University of Economics and Business, the participants of the CETAR Young Researcher Seminar at the University of Paderborn and the participants of the Research Workshop of the Faculty of Economics and Business (University of Paderborn) in Bad Arolsen 2015 for their helpful comments. Any remaining errors or inaccuracies are, of course, our own. Financial support from the Austrian Science Fund (FWF grant W 1235-G16) is gratefully acknowledged.

1. Introduction

The aim of this paper is to examine which tax allocation system for multinational groups (MNGs) causes more severe distortions of locational investment decisions. We consider two systems, namely separate accounting (SA) and formula apportionment (FA). As both are based on a fundamentally different mechanism for determining the tax base per entity, they offer different incentives with respect to the favorable country of investment. We use the optimal investment decision from a pre-tax perspective as a benchmark to assess the level of distortion caused by taxation. Thus, taking a business perspective, we compare the optimal pre-tax investment decision with the optimal after-tax investment decision and infer from the difference in the allocation of investment funds which tax allocation system causes more severe distortions. Assuming comprehensive income shifting possibilities under SA, we find that the investment incentives under SA are opposed to those under FA for a profitable investment project. Whereas under SA as much as possible should be invested in a high-tax country, under FA as much as possible should be invested in a low-tax country. Furthermore, locational investment decisions tend to be distorted more severely under SA if the largest share of investment funds is invested in the low-tax country from a pre-tax perspective. Vice versa, locational decisions may be more distorted under FA if the optimal pre-tax investment decision requires investing a major share of funds in the high-tax country. In contrast to the often stated insensitivity of FA towards income shifting, we find the introduction of a tax allocation system based on FA in Europe could lead to a severe shift of economic substance to low-tax countries.

The effects of both tax allocation systems have been hotly debated in Europe in the past years,[1] the reason being that the EU Member States are striving to implement a common European tax system. If this should come to pass, the traditional system of SA used currently across the EU will be replaced by FA. The idea behind the Common Consolidated Corporate Tax Base (CCCTB) system is to harmonize EU Member States' tax bases in order to reduce the economic hurdles resulting from 28 different national tax systems. In 2011, the European Commission proposed a Council Directive on a CCCTB.[2] If the CCCTB is introduced, European MNGs would need to apply only one tax code to determine their tax base. The profits and losses of all single entities could be consolidated on the group level. The consolidated group tax base would subsequently be allocated to each entity according to an apportionment formula based on assets, labor, and sales.

In a globalizing world, companies increasingly establish a multinational company structure to remain competitive and build more permanent establishments and subsidiaries abroad.[3] By doing so, they hope to, e.g., tap into new markets, relocate production closer to the required natural resources, or to access lower-wage labor. Furthermore, MNGs attempt to create a tax-favorable group structure so they

[1] For an overview of the historical development of the idea to harmonize the tax systems in Europe see Dahle (2011), pp. 107-109.
[2] See European Commission (2011).
[3] See Devereux & Maffini (2006), p. 1.

can benefit from tax rate differentials between countries. There is plenty of empirical evidence[4] to indicate that MNGs shift income from high-tax to low-tax countries. They do so largely via two channels. Either MNGs shift accounting profits, meanings they merely move book values. Alternatively, they shift real economic substance, e.g., workforce and assets, to generate profits or losses in tax-favorable environments. Thus, real activity shifting certainly affects the structure of an MNG. In this study we focus on locational decisions relating to real investments as a specific form of real activity shifting. Whereas previous studies mainly identify the direction of activity shifting under either tax allocation system separately, we go one step further and determine the level of activity shifting under either tax allocation system and subsequently compare their respective distortive power.

The fiscal environment is currently undergoing vast changes. In the context of its Base Erosion and Profit Shifting (BEPS) project, the OECD stated that "[t]axation is at the core of countries' sovereignty, but in recent years, multinational companies have avoided taxation in their home countries by pushing activities abroad to low or no tax jurisdictions."[5] This statement stresses that fiscal authorities are increasingly concerned about how to ensure that MNGs pay their fair share of taxes in the respective countries. Accordingly, the aim of the BEPS project is to change fiscal framework conditions on an international level in such a way that income shifting is prevented. There are two major tax allocation systems according to which the taxable share of each group entity is determined: SA and FA. SA is currently used in Europe and in most countries around the world. Under SA, each group entity that is incorporated in one country is treated distinctly and has to calculate its tax liability separately according to national tax laws. Under FA, the uniformly determined profits and losses of the entities are consolidated on the group level and are subsequently allocated to the group entities according to a specific apportionment formula. This formula is designed to capture the economic share contributed by each entity to the MNG's profits. FA is already well-known as it is in use, e.g., on the state level in the USA and Canada for cross-state or -province tax base allocation. Empirical and analytical studies show that activity shifting is conducted under both systems.[6] However, to our knowledge there is no study that compares the distortive impact of either system on locational investment decisions. As both tax allocation systems apply different mechanisms to determine the taxable share per country, they each offer varying leeway for avoiding taxes with respect to activity and accounting profit shifting.

From a macroeconomic perspective, a basic prerequisite for a good tax system is efficiency. Economic entities ought to be taxed in such a way that the scarce resources of an economy are allocated in a welfare-enhancing manner. Generally, free competition between economic entities is considered the market type that leads to such welfare-enhancing allocation. Thus, the tax system ought to be designed in such a way that it does not affect free market conditions. Consequently, economic entities'

[4] See section 2, literature review.
[5] See OECD (2013), p. 9.
[6] See Martini et al. (2013), Altshuler & Grubert (2010).

decisions should not be affected and investment decisions should not be distorted by corporate taxation.[7] In this study we investigate to what extent SA and FA are capable of ensuring such neutrality with respect to locational investment decisions.

We develop an analytical model to resolve our research question, namely which tax allocation system causes more severe distortions to locational investment decisions. The MNG has to decide which share of total investment funds to invest in each entity. We take a two-step approach, first determining the optimal after-tax allocation of investment funds under both tax allocation systems. The optimal after-tax allocation of investment funds is characterized by the highest after-tax cash flows under each system. Second, to determine the level of distortion caused by each system, we calculate the difference between the optimal allocations of investment funds from a pre-tax and an after-tax perspective. By comparing these differences we can derive conclusions about the distortive power of each system – the greater the difference, the greater the distortive power. The optimal economic pre-tax investment decision is determined by the relative demand per country, as the MNG will aim to produce wherever its sales are incurred. The optimal after-tax investment decision is modeled explicitly in our analysis. In our model the MNG faces a trade-off between choosing a tax-optimal allocation of investment funds and an optimal allocation from a purely economic pre-tax perspective.

We chose a two-country, two-entity setting for an MNG and assume a tax rate differential between both countries. Under SA, we assume that book income can be shifted comprehensively due to favorable transfer pricing arrangements. The shifting possibilities allow for the geographic segregation of sales and expenses, which directly affects the locational investment decision. We are convinced that it is also possible to shift book income under FA[8] but do not believe that this has a direct impact on the locational investment decision. As under FA the allocation of profits is based on the location of real economic factors, it ought to be an MNG's first priority to locate the economic factors in a tax-optimal way.

The results of this paper are of particular interest for European policy makers. On an aggregated level, our results make it possible to anticipate the macroeconomic effects induced by the potential introduction of the CCCTB system. Furthermore, our results can benefit European MNGs that face locational investment decisions. As we take a business perspective, our results may induce European MNGs to reassess their recent locational investment decisions in the face of a potential future change in the applied tax allocation system. Although our analysis is mainly motivated by the European debate around introducing the CCCTB, the results are also interesting for policymakers and MNGs in other parts of the world. On the state level in the US FA and SA coexist. As a matter of principle, the states apply formula apportionment. However, "if the allocation and apportionment provisions […] do

[7] See Kruschwitz et al. (2003), p. 328.
[8] See Kiesewetter et al. (2014).

not fairly represent the extent of the taxpayer's business activity in this state"[9] US based companies may also apply separate accounting. Prior US studies on FA[10] have examined its distortive effects yet we are the first to compare the level of distortion induced by FA relative to that induced by SA. Thus, our results may offer new input for potential reform debates about the coexistence of both systems in the US.

The next section consists of a brief review of the related literature. Section 3 presents the assumptions and the model set-up. In Section 4 we examine which tax allocation system offers stronger incentives to make an optimal locational investment decision, on the assumption that no costs are incurred by production and sales being in different countries. In Section 5 we introduce costs for production and sales being in different countries and determine the conditions under which either tax allocation system more severely distorts the investment decision. We conclude with a discussion of the managerial and tax policy implications.

2. Literature Review

Two main streams of research are relevant to our research question. First, prior research examines the impact of taxation on the location of profits and of investment decisions. Many empirical studies investigate how tax rate differences between countries affect the location of profits of MNGs. All of these studies are conducted in an SA setting. We, too, examine the relationship between the location of profits and tax rate differentials. However, doing so reflects our research question only on an aggregated level since we go one step further and examine the underlying locational investment decisions that determine the location of profits.

Harris et al. (1993) examine the level of tax payments of US parent companies depending on the location of their subsidiaries. They find evidence that groups with subsidiaries in low-tax countries pay relatively fewer taxes in the US compared to those that have subsidiaries in high-tax countries. They conclude that US MNGs are likely to shift income. In line with that finding, Bartelsman and Beetsma (2003) find evidence for income shifting in 16 OECD countries as well. They estimate that at the margin 65% of additional revenues from a unilateral tax increase is lost due to a decrease in the reported tax base. By contrast, the more recent income shifting literature identifies fundamentally smaller shifting effects in response to changes in tax differentials. In a meta-analysis Heckemeyer and Overesch (2013) review empirical studies on profit shifting and find that overall, reported profits decrease by about 0.8% for each one percentage point increase in the tax differential between countries. Dischinger et al. (2014) focus on the role of the location of the headquarters of MNG that shift income. Using a large European panel data set, they find that MNGs shift income to a significantly larger extent if the tax rate in the country of headquarter domicile is lower than that in the

[9] Uniform Division of Income for Tax Purposes Act (1966), pp. 12-13.
[10] See Gordon & Wilson (1986), Goolsbee & Maydew (2000).

domiciles of the subsidiaries. For a comprehensive literature review on the impact of taxes on the location of profits, see Dharmapala (2014) and Devereux and Maffini (2006). In line with our findings and assumptions, all studies find evidence for (accounting) income shifting on the part of MNGs.

Some literature also focuses specifically on the impact of taxes on locational investment decisions. Buettner (2002) empirically examines the relationship between statutory tax rates and foreign direct investment (FDI). He analyzes bilateral FDI flows and finds evidence that tax incentives affect the location of FDI. An increasing difference between the statutory tax rates of the entities' countries of domicile is related to an increase in FDI outflows. Gorter and Parikh (2003) and Bénassy-Quéré et al. (2005) find similar results. At first glance, their results, which implicitly assume SA, seem to contradict ours, since we find that under SA, MNGs preferably invest in high-tax countries. However, whereas we assume that the MNG already has well-established business activities in both types of country and only decides on subsequent investments, the cited studies examine investment decisions prior to establishing a new subsidiary. Thus, the previous studies focus on the earlier stages of the investment decision.[11] Our analysis is based on the assumption that the MNG has already taken such a decision and subsequently established a subsidiary in a low-tax country. Thus, in our setting the MNG can shift income to a company that is already established in the low-tax country, which we model explicitly.

Overesch (2009) assumes a setting that is closer to ours. He empirically investigates whether MNGs' real investment in high-tax countries is affected by income-shifting opportunities. Based on a panel of German inbound investments he finds evidence that investments in high-tax countries increase if the MNG is able to shift income to low-tax jurisdictions. Furthermore, Grubert (2003) finds empirical evidence that companies with good income shifting opportunities preferably invest in countries with either very high or very low statutory tax rates. The results of both studies are consistent with our findings under SA.

Two studies focus on investment incentives in a formula apportionment setting. Gordon and Wilson (1986) analytically investigate how FA affects companies' investment incentives. They conclude that a three-factor apportionment formula *de facto* creates three different taxes. Furthermore, largely in line with our results, they find that a formula consisting of assets, labor and sales creates incentives to produce in low-tax countries and sell in high-tax countries. Goolsbee and Maydew (2000) find in a study based on US data that, on average, a reduction in the formula factor weight of payroll from one third to one quarter increases manufacturing employment by around 1.1%. Our findings lend further support to these results. The first stream of research gives us an idea of what kind of investment

[11] According to the classification of Devereux & Maffini (2006), p. 4, the cited studies focus on discrete investment choices (second level of the decision tree in Fig. 1) whereas we focus on continuous choices (third and fourth level of the decision tree in Fig. 1).

incentives are created by which tax allocation system. However, we cannot infer which system creates relatively stronger investment incentives and which has relatively stronger distortive power.

The second main stream of research relevant to our study focuses on the comparison of separate accounting and formula apportionment with respect to various aspects. Many studies chose a public finance perspective. Nielsen et al. (2010) compare both tax systems with respect to basic properties such as their impact on capital formation, input choices and transfer pricing. They focus especially on the welfare effects of a switch from SA to FA. Nielsen et al. (2003) investigate the effects of a switch from SA to FA on income shifting via transfer pricing in a setting with imperfect competition. However, none of these studies focuses on the distortive power of one system relative to the other. In empirical research Oestreicher and Koch (2011) and Fuest et al. (2007) estimate the revenue consequences of the introduction of the CCCTB in the European Union in comparison to the currently applied system of SA. From these studies we can only vaguely infer the impact that a change in the tax system could have on locational investment decisions. Only few studies take a business perspective. In an analytical study Ortmann and Sureth-Sloane (2016) investigate the conditions under which SA or FA is preferable from the perspective of an MNG, with a particular focus on loss-offsets. These findings give us an idea of the tax base allocation system under which companies should invest in which country if they anticipate temporarily losses. However, the focus of this study is too narrow and hence not able to give us deeper insights into our research question. The study of Martini et al. (2012) is most relevant to our study with respect to the economic setting and the research question. In an analytical setting they investigate the impact of various tax allocation regimes on production and investment decisions. However, they have a managerial accounting focus and distinguish between centralized and decentralized decision structures within the MNG. Their study does not aim at comparing the level of distortion induced by each tax allocation system. Furthermore, unlike our study, they account only for profit scenarios and ignore losses.

To conclude, comprehensive research has been conducted on the impact of taxation on locational investment decisions under each individual tax allocation system. However, no studies explicitly measure the level of distortion induced by each tax allocation system; neither do they appear to have compared the respective levels of distortion. Although there is some literature comparing the specific properties of SA and FA, the studies disregard the distortive power they have on locational investment decisions. Our study aims to fill this gap.

3. Model

3.1. Assumptions

An MNG is assumed to consist of two group entities (entity A and B) that are located in country A and country B. The companies are fully affiliated. It is not necessary to specify which company is the parent and which is the subsidiary. As our model applies to a wide range of businesses, we provide a fairly abstract outline of the activities and characteristics of the MNG. Both group companies already have well-established business activities. They operate in the same industry, produce the same products or offer the same services, respectively. Each entity is responsible for selling the services/products to local customers. For reasons of simplicity, in the following we refer only to products, although this study applies to the provision of services as well. The executives of the MNG (for simplicity subsequently referred to only as "the MNG") plan to invest the amount I to expand the business. The MNG has to decide which share of investment funds I to invest in entity A and B,[12] respectively, to maximize its after-tax profits.

They invest the share a_τ^c (c indicates transportation costs, τ indicates an after-tax perspective, explained subsequently in more detail) in assets or workforce in country A and $(1 - a_\tau^c)$ in country B. The MNG is managed centrally. The investment in the MNG's business leads to the highest expected returns, so no other investment alternatives need to be considered. The executives can invest any share of investment funds in entity A or B, so the investment decision is continuous with respect to the allocation of the funds. It is conceivable that, for instance, the MNG considers investing a large amount in machinery or in hiring many workers in country A and/or B. Thus, as the investment in each individual investment object is rather low compared to the total investment amount, we assume a continuous allocation of investment funds as an appropriate approximation of accumulated investments throughout the group. By assumption, the share of investment a_τ^c and $(1 - a_\tau^c)$ in each entity finally leads to corresponding shares of sellable products per entity.

The production conditions are assumed to be identical in country A and country B. In other words, the probability of a successful outcome of the production processes is equal in both countries. Consequently, e.g., the workforce is equally trained and educated in both countries, the level of production know-how is identical and access to resources is identical. Consequently, we abstract from differences in productivity. A successful outcome means that the quality of the products is sufficient to sell them successfully at a profitable price. Furthermore, the costs incurred by the production process and the expected future profits from the investment are assumed to be identical before taxes in both countries. Thus, from a purely output-oriented pre-tax perspective the executives of the MNG are indifferent between investing in the entity in country A or country B. We could easily relax this assumption. However, to be able to isolate the tax effects we take advantage of the power of this stylized setting.

However, the executives are not only interested in the output of the investment, i.e., the quality of products, but also in the opportunities to sell these products to the customers in the respective countries. In this regard the countries deviate from each other. The demand for products need not

[12] Continuous investment decision is also modelled by Dietrich & Kiesewetter (2011), p. 103.

necessarily be the same in both countries. The MNG sells its products to customers in country A/B only via the local entity (entity A/B). Thus, we assume that selling products cross-border to end customers is impossible. Note, however, that selling products cross-border between both group entities is possible.[13]

Both countries levy corporate taxes on the entities' profits. The corporate tax rate in country A τ_A is assumed to be lower than that one in country B τ_B. The tax rates are assumed to be identical under FA and SA.[14] We assume an immediate full tax loss-offset as the entities are expected to generate enough profits from other, well-established business activities to compensate for a loss from the underlying investment project. Thus, the overall business of both entities is assumed to be profitable even if the outcome of the investment project itself may be negative. If the funds are invested in assets (e.g. machinery) they are fully depreciable in the period under review.[15] For reasons of simplicity, in our model the investment amount I is normalized to unity.[16]

As each entity sells its products only to local customers (customers in country A or B, respectively) and as the MNG produces and sells only enough products to exactly meet the aggregated demand of both countries, the relative demand in both countries is equal to the relative volume of sales of the group entities. The location of sales cannot be manipulated given the fixed location of end customers.[17] Consequently, the relative sales per country are set in our model. The relationship between sales in country A and sales in country B is assumed to remain constant irrespective of the success of the investment project. Note that it is not possible to make any inferences from the relationship of sales between the entities regarding the relationship between productions in the respective entities. The entities could sell products to end customers that they have produced themselves or products they have bought from the other group entity, since inter-group-entity trade is possible. Due to tax planning considerations, the volumes of products produced and products sold may differ per entity.

With a probability p the development of the investment is successful and the share sold by each entity to end customers is multiplied by the factor $(1 + u),\ u > 0$. The factor $(1 + u)$ captures the price for the products. The price level is related to the quality of the products. Thus, a high selling price represents a successful production process and high product quality. Note that the investment amount I is normalized to unity, so the price is adjusted in relation to the normalization of I.[18] As the production conditions are identical in both countries the probability p for a successful development of the investment must be identical as well. With the probability $(1 - p)$ the development of the investment

[13] The concept is well-known in international marketing literature, see for example Binckebanck (2012), p. 387.
[14] Also assumed by Oestreicher & Koch (2011).
[15] Assuming the full depreciation of investment funds in the first period is also a good approximation for multi-period analyses in the current low interest rate period and in case of full loss-offset possibilities.
[16] See Nielsen et al. (2010), p. 123.
[17] See Dyreng & Markle (2013), p. 9.
[18] See Nielsen et al. (2010), p. 123.

is not successful and leads to a loss. In such a case the share sold by each entity is multiplied by $(1-u)$. Thus, the quality of the products is low and their selling prices are too. For reasons of simplicity the successfulness of the investment project is only reflected in the price of the products, not in the quantity of sold units. However, e.g., in case of an unsuccessful investment, the lower selling price could also be reinterpreted as a reduction in sold products at a constant price level.[19] Due to the exogenously given probabilities for a good development of the project (p), we can determine the expected after-tax profits/losses of the MNG.

Specific costs will occur if the location of production, i.e., where the MNG invested in assets/labor, differs from the location of sales. Thus, from an economic pre-tax perspective, the MNG would optimally allocate the investment funds between entity A and entity B according to the relative demand (which is equal to the relative sales) in each country. In such case no costs would occur since all products are produced there where they are sold. The variable α_e describes the share of total sales/demand incurred in country A (subscript e stands for the "economic", pre-tax perspective). The "specific costs" can be thought of as transportation costs, costs incurred by language barriers between the countries, or currency differences. In the following we summarize these costs under the term "transportation costs".[20] Whereas we model the optimal after-tax allocation of investment funds explicitly, the optimal allocation of investment funds from an economic, pre-tax perspective is indirectly determined by the occurrence of sales $({\alpha_e}^*)$. The sales are, in turn, exogenously given by local demand. In our model, the MNG faces a trade-off between allocating the investment funds in order to reduce tax payments and in order to lower transportation costs. The MNG aims to find the allocation of investment funds $({a_\tau^c}^*)$ that leads to highest after-tax cash flows, i.e., the optimal investment decision.

If the share of products sold (α_e) is not identical to the share of products produced (a_τ^c) by the entity in country A, entity A either has to buy part of the products from entity B $(\alpha_e > a_\tau^c)$ or has to supply entity B with products $(\alpha_e < a_\tau^c)$. As both companies produce in sum exactly as many products as demanded in sum in both countries, the surplus of products produced by entity A can be sold to entity B, which sells them to the customers in country B, and vice versa. By subtracting a_τ^c from α_e we obtain the share of produced products that exceeds the share of products that can be sold directly by entity A. Table 1 graphically illustrates these relations.

[19] Similarly modelled by Devereux & Griffith (1998), p. 340.
[20] Devereux & Griffith (1998), p. 336 also focus on transportation costs as the crucial factor in deciding where to produce.

	Country A	Country B
share of products produced	a_τ^c	$(1 - a_\tau^c)$
share of demand = share of products sold	α_e	$(1 - \alpha_e)$
$a_\tau^c > \alpha_e$	More products produced than sold → difference $(a_\tau^c - \alpha_e)$ transferred to entity B	More products sold than produced → difference $(a_\tau^c - \alpha_e)$ supplied by entity A
$a_\tau^c < \alpha_e$	More products sold than produced → difference $(\alpha_e - a_\tau^c)$ transferred to entity B	More products produced than sold → difference $(\alpha_e - a_\tau^c)$ supplied by entity A

Table 1: Relations between sold and produced products per country

Transportation costs need to be further specified. We assume that the deviation from the optimal economic, pre-tax allocation of funds causes quadratic costs. Hence, the more the MNG deviates from the optimal economic allocation of funds in the investment decision, the higher the expected costs resulting from the deviation:[21]

$$E[C] = c \cdot (a_\tau^c - a_e)^2. \tag{1}$$

The bigger the difference between the optimal allocation of funds from a pure tax perspective and an economic, pre-tax perspective, the more products need to be transferred cross-border from country A to country B or vice versa. We assume that more inter-group-entity trade requires a more professional product exchange system between the entities. The required higher level of sophistication causes higher (quadratic) costs.

3.2 After-tax cash flows

In this subsection we build a model to calculate the after-tax cash flows. In the following sections (Sections 4 and 5) we determine the optimal after-tax allocation of investment funds in order to determine the level of distortion caused by each tax system. The optimal after-tax allocation of investment funds is characterized by the highest resulting after-tax cash flows. Thus, to clarify, here we introduce a model to calculate the after-tax cash flows only with the aim of deriving the optimal after-tax allocation of investment funds a_τ^{c*}. We are not interested in the level of maximal after-tax cash flows under each tax system *per se*; rather, we need to calculate them to identify the optimal allocation of investment funds a_τ^{c*}.

The expected sales for the MNG are calculated as follows:

[21] Quadratic transportation costs are a common assumption in spatial industrial economics; see Andree (2014), p. 195. See also Jara Diaz (1982).

$$E[S] = p * \big(\alpha_e \cdot (1+u) + (1-\alpha_e) \cdot (1+u)\big) +$$

$$(1-p) * (\alpha_e \cdot (1-u) + (1-\alpha_e) \cdot (1-u)). \tag{2}$$

The expected after-tax cash flows $E[CF^{Group}]$ of the MNG are obtained by deducting the expected tax payments $E[\text{TP}]$, the expected transportation costs $E[C]$, and the investment costs (normalized to unity) from the expected sales $E[S]$.

$$E[CF^{Group}] = E[S] - E[\text{TP}] - E[C] - 1. \tag{3}$$

The expected transportation costs $E[C]$ and the expected tax payments $E[\text{TP}]$ are a function of the decision variable a_τ^c; see eqs. (1, 5 and 6). The expected tax payments $E[\text{TP}]$ depend on the applied tax allocation system; we show in the following two subsections how they are determined under FA and under SA, respectively. To determine the expected tax payments from the investment project we calculate the tax payments in the good and bad case for both entities and weight them with the probability of success. See Table 1 for a tabular overview under SA.

3.2.1 Separate Accounting

If products are traded cross-border between the group entities, transfer prices need to be applied under SA. Furthermore, transportation costs are incurred for the cross-border trade between the entities. We assume that these costs are borne equally by both entities. Thus, the costs reduce the tax base of both entities equally. The International Commercial Terms (Incoterms)[22] contain rules that are intended to clearly communicate the costs incurred by the transportation of goods. Incoterms are widely used in international trade. In most of the cases considered in Incoterms, the transportation costs are somehow shared between the buyer and the seller. Thus, as an approximation, we assume that the transportation costs are equally shared between both group entities. The transportation costs could be used to incur costs in the more tax-favorable country. However, for reasons of clarity we account for manipulations of the tax bases only by transfer prices n.

If company A produces more products than it sells, it transfers these excess products to entity B at the transfer price n. By assumption the tax authorities accept the applied transfer price. Consequently, the following expression reflects the total expected transfer pricing payments (TPP) from entity B to entity A:

$$E[TTP] = n \cdot (a_\tau^c - a_e). \tag{4}$$

Depending on the relation between α_e and a_τ^c, the transfer payments increase or decrease the tax bases of entity A or entity B. If, for example, entity A sells more products than it produces, it receives products from entity B and has to make transfer payments to entity B. Table 2 shows the tax bases for

[22] ICC Germany (2015).

both entities in the good and the bad case after transfer pricing considerations. Note that the expected transfer pricing payments $n \cdot (a_\tau^c - \alpha_e)$ are added to the tax base of entity A and subtracted from the tax base of entity B. Thus, it depends *de facto* on the sign of the term $(a_\tau^c - \alpha_e)$ if the tax base of entity A or B is increased or decreased by the transfer payments.

	entity A	entity B
good p	$(\alpha_e \cdot (1+u) - a_\tau^c - 0.5\,c \cdot (a_\tau^c - \alpha_e)^2$ $+n \cdot (a_\tau^c - \alpha_e))$	$((1-\alpha_e) \cdot (1+u) - (1-a_\tau^c) - 0.5\,c(a_\tau^c - \alpha_e)^2$ $-n \cdot (a_\tau^c - \alpha_e))$
bad $(1-p)$	$(\alpha_e \cdot (1-u) - a_\tau^c - 0.5\,c \cdot (a_\tau^c - \alpha_e)^2$ $+n \cdot (a_\tau^c - \alpha_e))$	$((1-\alpha_c)\cdot (1-u) - (1-a_\tau^c) - 0.5\,c \cdot (a_\tau^c - \alpha_e)^2$ $-n \cdot (a_\tau^c - \alpha_e))$

Table 2: Tax bases in each case under SA after transfer pricing

The expected tax bases per country are then determined by weighting the tax bases per case with the probability of success p and $(1-p)$. Eq. (5a) and eq. (5b) reflect the expected tax bases for entity A and entity B.

$$E\left[TB_{SA}^{A}\right] = p \cdot (\alpha_e \cdot (1+u) - a_\tau^c - 0.5\,c \cdot (a_\tau^c - \alpha_e)^2 + n \cdot (a_\tau^c - \alpha_e)) + (1-p) \cdot \ (\alpha_e \cdot (1-u) - a_\tau^c - 0.5\,c \cdot (a_\tau^c - \alpha_e)^2 + n \cdot (a_\tau^c - \alpha_e)), \tag{5a}$$

$$E\left[TB_{SA}^{B}\right] = p \cdot ((1-\alpha_e) \cdot (1+u) - (1-a_\tau^c) - 0.5\,c \cdot (a_\tau^c - \alpha_e)^2 - n \cdot (a_\tau^c - \alpha_e)) + (1-p) \cdot ((1-\alpha_e)\cdot (1-u) - (1-a_\tau^c) - 0.5\,c \cdot (a_\tau^c - \alpha_e)^2 - n \cdot (a_\tau^c - \alpha_e)). \tag{5b}$$

We obtain the expected tax payments for the whole group by multiplying the expected tax base per country with the respective tax rate. Eq. (6) shows how the overall tax payments are calculated:

$$E\left[TP_{SA}^{Group}\right] = E\left[TB_{SA}^{A}\right] \cdot \tau_A + E\left[TB_{SA}^{B}\right] \cdot \tau_{B.} \tag{6}$$

3.2.2 Formula Apportionment

For apportioning the consolidated tax base of an MNG the design of the formula is decisive. The so-called Massachusetts Formula consists of the equally weighted factors assets, labor and sales: $\frac{1}{3} \cdot (\frac{sales\ of\ enitiy\ i}{sales\ of\ the\ group} + \frac{assets\ of\ enitiy\ i}{assets\ of\ the\ group} + \frac{labor\ expenses\ of\ enitiy\ i}{labor\ expenses\ of\ the\ group})$.

The Massachusetts Formula is – with a small deviation – the proposed formula for apportioning the tax base of European MNGs under the CCCTB system. Only in the calculation of the factor "labor" does the proposed formula under the CCCTB system deviate slightly from the Massachusetts Formula. Whereas the labor factor consists only of the expenses for the workforce under the Massachusetts Formula, it consists in equal parts of those expenses and number of workers under the proposed

CCCTB formula. However, this small simplification of the Massachusetts Formula is negligible for the purpose of our analysis. The Massachusetts Formula was originally used by almost all states in the US to apportion the consolidated tax base of national groups to the entities. However, whereas under the proposed CCCTB system the factors are weighted equally, in the US there is room for deviation from these weights. States tend to give more weight to the sales factor and distribute the remaining weights equally across the asset and the labor factor. As we focus on the CCCTB setting in this study we assume fixed and equally weighted factor weights as under the Massachusetts Formula.

Furthermore, we assume that under FA the share of assets is equal to the share of labor for each entity. The basic idea of this assumption is that assets, e.g., machinery, require a proportional number of workers to operate them. Thus, they are seen as complements.[23] Note that the MNG already has some well-established business activities that also have to be taken into account when determining the allocation of the group tax base. The existing shares of assets, labor, and sales per entity induced by other business activities are assumed to correspond to the shares of these factors that result from the investment. Thus, the allocation of the group tax base between the entities does not change due to the investment. Consequently, the variables α_{τ}^{c} and α_e contain all necessary information to determine which share of the group tax base is allocated to which entity.

In contrast to SA, under FA the costs and sales from the investment are consolidated on the group level. Thus, the MNG cannot benefit from segregating expenses and sales and incurring them separately in tax-favorable environments. We take the provisions governing FA under the CCCTB system as a model for this study. According to Section 96 of the CCCTB proposal,[24] sales are assigned to the destination country of the sold products. Thus, under FA, it is generally possible to segregate the location of sales and the location of assets and labor (i.e., the location of production). Under FA, segregation is decisive for the tax-optimal arrangement of the apportionment factors between country A and country B. Note that such a segregation would not be possible if the sales were assigned to the country where the products were produced. Due to the consolidation of profits and/or losses on the group level, no transfer pricing issues arise. As a side note, it would not make a difference to the sales factor if we relax the assumption of prohibiting direct sales in other countries. If we assume that entity A sells its products directly to the end customers in country B instead of selling them indirectly to them via entity B, the share of the group tax base allocated to each entity does not have to be adjusted.

The formula apportionment systems that exist around the world offer different ways to deal with losses. Whereas in the US the overall loss of the group is allocated to the group members and is carried forward on the entity level, under the European CCCTB system it is not allocated to the group entities and is carried forward on the group level. However, in the scenario considered here we assume that the group incurs profits from other business activities so that the overall tax base of the group is

[23] See Runkel & Schjelderup (2011), p. 916 and Dietrich & Kiesewetter (2007), p. 507.
[24] See European Commission (2011).

positive and losses can be offset against profits within the group. Consequently, under this assumption we do not need to distinguish between a formula apportionment system that does or does not allow for allocating losses to the entities.

To apply the apportionment formula we need to know which share of sales, assets, and labor accrue in which country. As described in the section headed "Assumptions", the variables α_e and $(1-\alpha_e)$ represent the shares of sales and the variables a_τ^c and $(1-a_\tau^c)$ represent the shares of assets and labor present in each country. The transportation costs do not impact the relative allocation of assets and labor between the countries. The MNG is assumed to outsource transportation to a logistics company. The share of assets and labor is assumed to be equal in each country. Thus, the share of the overall tax base apportioned to country A is calculated as follows

$$f_A = \frac{1}{3}(\alpha_e + 2 \cdot a_\tau^c). \tag{7}$$

Consequently, the share allocated to country B is $f_B = (1 - f_A)$, respectively.

Due to cross-border consolidation, the expected tax base on the group level is determined by summing up the results of both group entities:[25]

$$\begin{aligned} E\left[TB_{CCCTB}^{Group}\right] &= E[S] - E[C] - 1 \\ &= (-1 + 2p) \cdot u - c * (a_\tau^c - \alpha_e). \end{aligned} \tag{8}$$

By multiplying the tax base with the apportionment factors $f_A \cdot \tau_A$ and $f_B \cdot \tau_B$, we obtain the expected tax payments of the group:

$$E\left[TP_{CCCTB}^{\text{Group}}\right] = E\left[TB_{CCCTB}^{\text{Group}}\right] \cdot (f_A \cdot \tau_A + f_B \cdot \tau_B). \tag{9}$$

4 No costs for the segregation of sales and assets/labor

In a first step, we assume that no transportation costs (or costs for language or currency differences) are incurred for products that are sold within the group. Such a setting would be reasonable for example in the EU, where two countries have the same currency, have the same official language, and where intangible products like software are sold by one entity to another. However, a setting without transportation costs may be more specific than a setting with transportation costs. As we assume no transportation costs, there is no optimal pre-tax investment decision. From a pre-tax perspective the group is indifferent to investing in country A or country B. Therefore, in this section we cannot draw any conclusions about the level of distortion caused by each tax system. However, as a preliminary step, we can infer which tax allocation system offers stronger incentives to make a tax-optimal

[25] Note that unlike under SA, transfer prices do not affect eq. (8).

investment decision. The incentive for an optimal investment decision is measured by the additional tax payments that are caused by a marginal deviation from the optimal after-tax allocation of funds. The higher the additional marginal tax payments, the higher the incentives to invest optimally. In the next section we introduce transportation costs and thus are able to draw conclusions about the level of implied distortions. As the assumption of zero transportation costs slims down the complexity of the model, it allows us to understand the basic mechanism behind each tax allocation system in depth. It thus also serves to prepare for the following more complex model setting with transportation costs. Note that in this section we label our decision variable α_τ (not a_τ^c) as no transportation costs c occur. However, with exception of the transportation costs, the explanations and formulas given in Section 3 for a_τ^c are fully applicable to this section, too.

The after-tax cash flows indicate for which value of α_τ the after-tax allocation of funds is optimal ($\alpha_\tau{}^*$), i.e., when the after-tax cash flows are maximal. However, in case the transportation costs are assumed to be zero, we refrain from modeling the after-tax profits explicitly. The investment decision does not affect the expected pre-tax cash flows ($E\left[CF_{No\ Costs}^{Group_{pre-tax}}\right] = E[S] - 1$) but only the tax payments. Thus, as tax payments are the only dimension that is affected by the decision variable α_τ, here we focus only on tax payments. The after-tax cash flows can be easily determined by subtracting the tax payments from the pre-tax cash flows of the MNG. The higher the tax payments, the lower the after-tax cash flows.

4.1 Separate Accounting

To determine the optimal after-tax investment decision under separate accounting, we need to know for which value of α_τ the expected tax payments of the group $E\left[TP_{SA}^{Group}\right]$ are lowest. Remember that in this setting without transportation costs, it is sufficient to consider only the tax payments in order to conclude for which value of α_τ the expected after-tax profits are highest. By differentiating the expected tax payments $E\left[TP_{SA}^{Group}\right]$ with respect to the share of investment funds invested in A α_τ we can draw conclusions about how a change of invested funds affects the overall expected tax payments of the MNG:

$$\frac{\partial E\left[TP_{SA}^{\text{Group}}\right]}{\partial \alpha_\tau} = (\tau_A - \tau_B) \cdot (n-1). \tag{10}$$

Since by assumption the tax rate in country B is higher than that in country A ($\tau_B > \tau_A$), the expression in the first bracket is always negative. The bigger the tax rate differential, the higher the impact of a change in the allocation of investment funds α_τ on the expected tax payments $E\left[TP_{SA}^{\text{Group}}\right]$. The transfer price n determines whether a change in α_τ affects the expected tax payments positively or negatively (expression in the second bracket). As the MNG strives to minimize its tax burden, it strategically sets transfer prices in order to benefit from tax rate differentials.[26] Anecdotal and empirical evidence gives us an idea of how MNGs *de facto* set their transfer prices in a scenario as assumed in our model.[27] A statement by the former chief financial officer of the automotive manufacturer BMW suggests that BMW strategically attempted to uncouple the location of expenses from the location of sales. At a press conference on financial statements, the CFO announced that the company attempted to accrue expenses wherever the tax rates were highest.[28] Subsequently, top executives at BASF and Merck referred to the tax organization of BMW as a role model for their own groups.[29] Based on those statements, Feld (2000) states that MNGs have opportunities to incur costs in that country with the relative higher tax rate and use income-shifting channels like transfer pricing structures to incur profits in low-tax countries. Empirical evidence found by Egger et al. (2010) supports Feld's finding that MNGs attach particular importance to the costs of an investment when choosing the investment location. They find evidence that in Europe, profit shifting seems to be more pronounced than debt shifting. As MNGs have an incentive to separate investment costs from the resulting sales for tax purposes, and as it seems to be easier for them to shift the resulting sales than the costs, the investment is ideally carried out in a high-tax country and the resulting sales are then shifted to low-tax countries. Consequently, MNGs seem to focus on placing the real activity (i.e., labor and assets) in a favorable high-tax tax environment if they have an opportunity to shift income.

There is also some empirical evidence that indicates that MNGs are able to uncouple the costs of an investment from the resulting sales. Grubert (2003) finds that MNGs invest either in extra-low- or in extra-high-tax countries if they have good opportunities for income-shifting. MNGs invest in extra-low-tax countries to establish a destination for the shifted income and in extra high-tax countries to benefit from high tax refunds on the resulting losses of the investment. Note that in our setting there is already a company in a low-tax country to which income can be shifted (entity A). Thus, in line with the findings of Grubert, the MNG aims to carry out the real investment in the high-tax country and may shift potential income to the low-tax country in our setting. The empirical evidence found by Overesch (2009) supports Grubert's results. Based on German panel data for inbound investments he finds evidence that real investment in high-tax countries is positively affected by a lower taxation of income shifted abroad. The results of an analytical study by Hong and Smart (2010) points in the same direction. They suggest that the possibility to shift income to tax havens makes the MNG less responsive to tax rate differentials when choosing the location where the investment shall be carried out.

[26] See Dietrich & Kiesewetter (2011), p. 101.

[27] As both entities are assumed to produce identical products and sell them to end customers at the same expected price, at first glance it seems reasonable to use this expected price as the transfer price.[27] However, the expected price is only an estimated value for planning purposes and will certainly not occur, as the investment develops either positively or negatively. Thus, the expected market price cannot serve as a reasonable benchmark for the transfer price.

[28] Doppelfeld cited by Schaefer, (1993) p. 2.

[29] Weichenrieder (1996), p. 38.

There is also analytical evidence that indicates explicitly that MNGs try to incur costs or losses in high-tax countries. Results found by Becker and Fuest (2007) indicate that MNGs try to carry out real investments in high-tax countries if marginal profits are allowed to be negative. In our model the MNG incurs negative or zero marginal profits in the high-tax country since it shifts profits away. Becker and Fuest state that in such case higher taxes may attract more real investment. They argue that strategic investments in non-profitable projects could explain why the stock of foreign capital held in Germany increased tremendously between 1990 and 2000 even though the corporate tax rate was very high during that period. Haufler and Strähler (2013)'s argument for low tax bases in high-tax countries points in the same direction. They argue that firms rank their entities according to profitability. According to their line of argumentation, highly profitable low-cost entities settle in low-tax countries, which are usually fairly small. By contrast, high-cost entities settle in large, high-tax countries.

All in all, we infer from these studies that MNGs can geographically uncouple the expenses and sales of an investment. The most complete segregation between costs and sales is achieved when one entity produces all products and gives them free of charge to the other group entity, which sells them. Note that in our model the location of sales is determined by local demand and can be neither changed nor optimized. By contrast, the location of production can be determined by the MNG via the share of funds invested in the production process (in labor and assets, α_τ) in each country. If the producing entity offers the products free of charge to the selling company, the transfer price n takes on a value of zero ($n = 0$). If the producing entity sells the products to the selling company at its production costs, the transfer price amounts to one ($n = 1$). The transfer price is the only means for income-shifting in our model. We assume that the transfer price captures all possible income-shifting channels.[30] Besides shifting income via transfer pricing, the MNG could shift income, e.g., by internal debt[31] or by royalty payments. We assume comprehensive income-shifting opportunities so that the MNG is in any case able to set transfer prices that are smaller than or equal to one ($0 \leq n \leq 1$).

Eq. (10) illustrates that an increase in α_τ increases the expected tax payments $E\left[TP_{SA}^{Group}\right]$ if n is smaller than one ($n < 1$). In that case the entity, which produces more products than it sells to end customers, sells the remaining products to the other group entity at a price that is lower than the production costs. As follows from eq. (10), the partial derivative is strictly monotonously decreasing in α_τ if $n < 1$. As the definition range for α_τ is given by the interval [0,1], i.e, $0 \leq \alpha_\tau \leq 1$, the lowest expected tax payments/the highest tax refunds occur for $\alpha_\tau = 0$. That is to say, all investment funds are invested in country B. This conclusion is intuitive. As we assume an immediate and full loss-offset, the expected tax payments are lowest if as many investment-related expenses as possible are incurred in the high-tax country and – in case of successful development – if at the same time as much profits as possible are shifted to and taxed in the low-tax country. The more the transfer price n

[30] See Grubert & Mutti (1991), p. 286.
[31] See Dietrich & Kiesewetter (2011), p. 101.

approaches zero, the lower the expected tax payments or the higher the expected tax refunds, respectively. Thus, MNGs try to negotiate transfer prices in such a way that these are as low as possible. Furthermore, the closer the transfer price n is to zero, the higher the expected tax payments $E\left[TP_{SA}^{\text{Group}}\right]$ with an increase in α_τ.

Moreover, eq. (10) shows that in the case of a transfer price that is equal to the production costs $(n = 1)$ the partial derivative with respect to α_τ is equal to zero. Consequently, a marginal change in the allocation of investment funds α_τ does not impact the expected tax payments. Thus, the expected tax payments/expected tax refunds are independent of the value of α_τ. The intuitive explanation therefore is that at $n = 1$ the MNG is not able to allocate the investment costs between the two countries and thus it cannot strategically accrue losses in the tax-favorable environments. A value of $n = 1$ does not offer any scope for tax-motivated income-shifting.

4.2 Formula Apportionment

To get an idea of how the allocation of investment funds α_τ affects the expected tax payments/expected tax refunds $E\left[TP_{FA}^{Group}\right]$ under FA, we calculate the partial derivative of eq. (8) with respect to α_τ:

$$\frac{\partial E\left[TP_{FA}^{Group}\right]}{\partial \alpha_\tau} = \frac{2}{3} \cdot (\tau_B - \tau_A) \cdot (-1 + 2p) \cdot u. \tag{11}$$

The tax rate differential in the first brackets is by definition always positive. The variable u is by definition also always positive. Thus, only the probability of a successful production p determines if the marginal change in the allocation of investment funds α_τ affects the expected tax payments $E\left[TP_{FA}^{Group}\right]$ negatively or positively. If the probability of success is exactly one half ($p = 0.5$), then α_τ has no influence on the expected tax payments. That is intuitive as the expected tax base is then zero. If the probability of success p is smaller than 0.5 $(p < 0.5)$ we obtain an expected loss from the investment project. It follows from eq. (11) that in such a case, an increase in the share of investment funds α_τ in country A increases the expected tax payments. Thus, as the partial derivative shown in eq. (11) is strictly monotonously decreasing if $p < 0.5$, the MNG would be best advised to invest all funds in country B $(\alpha_\tau = 0)$. Under an immediate and full loss-offset, the expected tax payments for the MNG are lowest if all losses are allocated to the high-tax country B. In country B the tax refunds for the losses are highest. If p is greater than 0.5 $(p > 0.5)$, the investment generates expected profits. In such a case, an increase in α_τ decreases the expected tax payments since the partial derivative of eq. (11) is strictly monotonously increasing, so the MNG should invest all funds in A $(\alpha_\tau = 1)$.[32] The expected tax payments for the MNG are lowest if all profits are allocated to and taxed in the low-tax country A.

[32] See Dietrich & Kiesewetter (2007), p. 514.

4.3 Comparison of both tax allocation systems with respect to the incentives to invest optimally

A substantial difference between both tax allocation systems is that under FA the tax-favorable allocation of investment funds depends on whether the investment project is expected to be profitable or not. If the MNG expects a profit and invests the funds in line with this expectation but finally incurs a loss, the allocation of investment funds turns out to be worst from a tax perspective. By contrast, the optimal allocation of investment funds under SA does not depend on whether the MNG incurs profits or losses. As a side note, we refer always to the optimal investment decision from an after-tax perspective in this section as there is no optimal pre-tax investment decision (remember $c = 0$). Due to the possibility to segregate costs and sales, under SA, the MNG should always invest all funds in the high-tax country. Thus, in a profit scenario both tax allocation systems create opposing investment incentives, while in a loss scenario the incentives are identical. Our main goal in this section is to find out which tax allocation system creates stronger incentives (i.e., higher tax payments in case of a marginal deviation from the optimal after-tax allocation of funds) to invest optimally.

By comparing the partial derivatives for the expected tax payments with respect to α_τ with each other (eq. (10) and eq. (11)), it becomes evident under which system a potential misallocation of funds results in higher expected tax payments. To be more precise, we can infer from comparing eq. (10) with eq. (11) under which tax allocation system a marginal deviation from the optimal tax-allocation of funds $\alpha_\tau{}^*$ results in a stronger increase in expected tax payments. The stronger the increase in tax payments with a deviation from the tax-optimal allocation of funds, the stronger the incentives to invest tax-optimally. The partial derivative with respect to α_τ under SA is greater than under FA if the following condition holds:

$$n < \frac{1}{3} \cdot (3 - 2 \cdot u + 4 \cdot p \cdot u). \tag{12}$$

Under that condition the MNG has to pay more taxes for a marginal deviation from the optimal allocation of investment funds $\alpha_\tau{}^*$ under SA than under FA. Consequently, the incentives under SA are stronger than those under FA to allocate the investment funds optimally between both countries from an after-tax perspective. Vice versa, the incentives are stronger under FA if the following condition holds: $n > \frac{1}{3} \cdot (3 - 2 \cdot u + 4 \cdot p \cdot u)$. The relative distortive power of either tax allocation system depends on the relation between the transfer price n and the expected sales $p \cdot u$.

To get an idea of which tax allocation system offers stronger incentives to make an optimal investment decision, we determine realistic parameter settings. According to CSI Market[33] the pre-tax margin for US companies currently ranges between about 21% in the healthcare sector and about 5% in the retail sector. We take the median of this range (13%) as the expected average realistic pre-tax margin in our

[33] See CSI Market (2015).

analysis, allowing us to deduce a variety of possible combinations of p and u that lead to an expected pre-tax rate of return of 13%. For example, this is true for $p = 1$ and $u = 0.13$ (setting I) and $p = 0.6$ and $u = 0.65$ (setting II). For all combinations of p and u that lead to a pre-tax margin of 0.13, the incentives for an optimal allocation of investment funds are greater under SA than under FA if $n < 1.08667$. As by assumption $n \leq 1$, this relation always holds. The same interpretation, e.g., holds true for a pre-tax margin of 21% (healthcare sector, $n < 1.14$) or 5% (retail sector, $n < 1.03$). Thus, if the expectations of pre-tax margins are in line with currently observable sector margins of US companies, the incentives for an optimal allocation of investment funds are always stronger under SA than under FA.

Note that so far we have not been able to draw conclusions about the distortive effects of each tax allocation system with respect to locational investment decisions as there has been no optimal pre-tax investment decision ($c = 0$). The MNG has been assumed to be indifferent between investing in entity A or B from a pre-tax perspective. In the following section we change this assumption. By assuming transportation costs the MNG is no longer indifferent in the pre-tax allocation of investment funds. Thus, by introducing an optimal allocation of investment funds in the pre-tax scenario, we are able to draw conclusions about the distortional power of either tax allocation system.

5 Costs for the segregation of sales and assets/labor

So far we have determined the MNG's optimal allocation of investment funds across countries A and B assuming no transportation costs. Thus, until now taxation has been the only crucial determinant for deciding where to invest. Now we expand this setting and assume transportation costs incurred by the geographical segregation of sales and asset/labor (production). Hence, in this section the transportation costs are an additional determinant of the optimal investment decision. From a purely pre-tax perspective, the MNG should invest in entity A and entity B relative to demand in country A and country B (${\alpha_e}^*$) in order to avoid transportation costs.

The occurrence of an optimal allocation of investment funds from a pre-tax perspective (${\alpha_e}^*$) creates a trade-off between the optimal allocation of investment funds from a tax perspective and from a pre-tax perspective. Transportation costs force the MNG to weigh the economic pre-tax benefits against the taxation benefits to arrive at a final investment decision (${a_\tau^c}^*$).[34] Thus, the unidimensional optima from either a tax perspective or a pre-tax perspective are merged to form an overall, multidimensional optimum(${a_\tau^c}^*$). The transportation costs reduce not only the overall cash flows of the MNG but also the tax base.[35] Thus, it is necessary to explicitly model not only the tax payments – as in Section 4 – but the entire after-tax cash flows. Note that the main goal of this analysis is to find out the optimal

[34] Devereux & Griffith (1998) make a similar assumption. However, in their model transportation costs are weighed up against gains from economies of scale.
[35] Also assumed by Devereux & Griffith (1998), p. 340.

after-tax allocation of investment funds a_τ^{c*} (i.e., the allocation that leads to highest after-tax cash flows) in order to determine the distortional power of each tax base allocation system.

5.1 Separate Accounting

Under SA the allocation of the transportation costs between both entities is crucial for the tax payments of the MNG. The transportation costs $(c \cdot (a_\tau^c - \alpha_e)^2)$ have opposing effects on the expected after-tax cash flows $E\left[CF_{SA}^{Group}\right]$. On the one hand, they decrease the pre-tax profits; on the other hand, they decrease the tax base and thus the tax payments. However, the impact of the decrease in tax payments is in any case smaller than the decrease in pre-tax cash flows. Thus, the tax base effect of the transportation costs is smaller than the pre-tax effect. To find the optimal allocation of investment funds a_τ^{c*} the MNG has to weigh up the benefits from a tax-optimal allocation of funds against the benefits from an economically favorable allocation of funds (i.e., an allocation that results in low transportation costs). As the transportation costs are assumed to be quadratic, they start at a very low level and then increase rapidly. At a specific critical $\widetilde{a_\tau^c}$ the benefits of a tax-favorable allocation of investment funds are outweighed by the transportation costs. Given quadratic transportation costs, the expected after-tax cash flows (after transportation costs) decrease with an increasing deviation from the optimal after-tax allocation of funds a_τ^{c*}. Thus, the curve reflecting the expected after-tax cash flows $E[CF^{Group}]$ (see eq. (3)) depending on a_τ^c is bell-shaped.

Differentiating eq. (3) with respect to a_τ^c shows how a change in the decision variable a_τ^c impacts the expected after-tax profits:

$$\frac{\partial E\left[CF_{SA}^{Group}\right]}{\partial a_\tau^c} = \underbrace{(\tau_A - \tau_B) \cdot (1-n)}_{-/0} + \underbrace{\underbrace{(\tau_A + \tau_B) \cdot c}_{+/0} \cdot \underbrace{(a_\tau^c - \alpha_e)}_{+/-/0}}_{\mathrm{I}} + \underbrace{\underbrace{2c}_{+/0} \cdot \underbrace{(\alpha_e - a_\tau^c)}_{+/-/0}}_{\mathrm{II}}. \tag{13}$$

The symbols ("-/0" , "+/0" and "+/-/0") under the braces indicate the potential signs the expression can take in accordance with the model assumptions. The allocation of funds is optimal if the partial derivative of eq. (13) is equal to zero for a value of a_τ^{c*} that lies within a range of zero and one $(0 \le a_\tau^{c*} \le 1)$. Note that the (mathematical) optimum (i.e. where $\frac{\partial E\left[CF_{FA}^{Group}\right]}{\partial a_\tau^c} = 0$) need not necessarily lie in this economically reasonable area $(0 \le a_\tau^c \le 1)$. In such a case, a_τ^{c*} takes the extreme values of zero if the (mathematical) optimum occurs for values of a_τ^c smaller than zero or of one if the (mathematical) optimum occurs for values of a_τ^c bigger than one. We can draw this conclusion as the curve reflecting the expected after-tax results $E[CF^{Group}]$ (see eq. (3)) in dependence of a_τ^c is bell-shaped.

Eq. (13) shows that the relation between a_{τ}^{c} and α_e will determine how a change in the allocation of investment funds a_{τ}^{c} affects the expected after-tax cash flows $E\left[CF_{SA}^{Group}\right]$. The terms in eq. (13) labeled with I and II have opposing effects on the marginal change in expected after-tax cash flows in reaction to a marginal change in a_{τ}^{c}. However, the impact of term II on the marginal change of the expected after-tax cash flows is always stronger than that of term I. The following table illustrates under which conditions a change in a_{τ}^{c} affects the expected after-tax cash flows and how.

	$0 \leq n < 1$	$n = 1$
$a_{\tau}^{c} > \alpha_e$	$-$	$-$
$a_{\tau}^{c} = \alpha_e$	$+$	0
$a_{\tau}^{c} < \alpha_e$	ambiguous	$+$

Table 3: Impact of a_{τ}^{c} on the expected after-tax cash flows depending on the relation between n, a_{τ}^{c} and α_e under SA.

The table entry "ambiguous" indicates that the impact of a_{τ}^{c} on the expected after-tax results can be positive or negative, it depends on the specific parameter settings.

5.2 Formula Apportionment

Under FA it is not necessary to determine which share of transportation costs is borne by which entity since the group tax base is determined by consolidating all sales and expenses of both entities. However, the overall decision about the allocation of investment funds is more complex than that under SA. By introducing transportation costs into the model, under FA the optimal after-tax allocation of investment funds is driven by three effects. Transportation costs

- reduce the pre-tax cash flows (which affects the expected after-tax cash flows negatively)
- reduce the tax base (which affects the expected after-tax cash flows positively)
- change the apportion of the tax base across both entities (f_A) (where the impact depends on the specific constellation).

The following equation clarifies how a change in a_{τ}^{c} affects the expected after-tax results:

$$\frac{\partial E\left[CF_{FA}^{Group}\right]}{\partial a_{\tau}^{c}} = \underbrace{2(-1 + \alpha_{\tau} \cdot (\tau_A - \tau_B) + \tau_B)}_{-/0} \cdot \underbrace{c \cdot (a_{\tau}^{c} - \alpha_e)}_{-/+/0} - \frac{2}{3}\underbrace{(\tau_A - \tau_B)}_{+} \cdot \underbrace{(-1 + 2p) \cdot u}_{-/+/0} . \tag{14}$$

Again, the symbols ("+", "-/0" and "+/-/0") under the braces indicate the potential values of the respective terms under the given set of assumptions. The allocation of funds is optimal if the partial derivative of eq. (14) is equal to zero ($\frac{\partial E\left[CF_{FA}^{Group}\right]}{\partial a_{\tau}^{c}} = 0$) and the optimal allocation of investment funds lies within a range of zero and one ($0 \leq a_{\tau}^{c^*} \leq 1$). If that is not the case, more complex approaches have to be applied to find the optimum within the definition area of a_τ^c $(0 \leq a_\tau^c \leq 1)$.[36] Under FA the relation between a_τ^c, α_e and p determines whether a_τ^c affects the expected after-tax results positively or negatively. The probability of success p determines if the investment leads to an expected after-tax profit or loss. We show already in subsection 4.3 that under FA, the sign of the expected after-tax cash flows of the MNG (determined by p) is decisive for the optimal investment decision. Table 4 shows under which conditions a marginal change in a_τ^c affects the expected after-tax cash flows and how.

	$p < 0.5$	$p = 0.5$	$p > 0.5$
$a_\tau^c > \alpha_e$	$-$	$-$	ambiguous
$a_\tau^c = \alpha_e$	$-$	0	+
$a_\tau^c < \alpha_e$	ambiguous	+	+

Table 4: Impact of a_τ^c on the expected after-tax cash flows depending the relation between p, a_τ^c and α_e under FA.

If, for example, $a_\tau^c > \alpha_e$ and $p < 0.5$, an increase in a_τ^c reduces the expected after-tax cash flows. The table entry "ambiguous" indicates that the impact of a_τ^c on the expected after-tax results is ambiguous and depends on the specific parameter settings.

Under SA the expected after-tax cash flows decrease when a_τ^c deviates more strongly from the optimal after-tax allocation of investment funds a_τ^{c*} (bell-shaped curve, see subsection 5.1). Under FA that relation does not necessarily hold (under FA the curve is not necessarily bell-shaped). This is due to the rather complex impact of a_τ^c on the expected tax payments. Whereas under SA the introduction of transportation costs impacts the tax payments solely through the decreased tax base, under FA more complex interrelations between the tax base and its allocation impact the tax payments. Thus, with respect to the tax payments, an increasing difference between a_τ^c and $\alpha_e{}^*$ may be up to a critical value of $\widetilde{a_\tau^c}$ beneficial as higher costs reduce the tax payments. However, if that critical value of $\widetilde{a_\tau^c}$ is exceeded, the favorable tax base effects may be outweighed by an unfavorable allocation of the group tax base to the entities (i.e., extensive losses are allocated to the low-tax country or extensive profits to the high-tax country).

5.3 Comparison of distortional effects of both tax allocation systems

The introduction of transportation costs affects the locational decisions under FA in more dimensions than under SA. In addition to the expected pre-tax profits and the tax base, the allocation of the tax base between the group entities is affected as well. Under one of the following conditions the expected after-tax cash flows (after transportations costs) are higher under SA than under FA:

$$a_\tau^c < \alpha_e \text{ and } n < \tfrac{1}{6}\left(6 + 3\,\mathrm{c} \cdot a_\tau^c - 4\,\mathrm{c} \cdot {a_\tau^c}^2 - 3\,c \cdot \alpha_e + 2\,\mathrm{c} \cdot \alpha_e \cdot a_\tau^c + 2\,{\alpha_e}^2 - 4\,u + 8\,p\,u\right) \quad (15a)$$

[36] Note that the curve of $[CF_{FA}^{Group}]$ depending on a_τ^c is not necessarily bell-shaped (as it is under SA). Thus, finding the maxima within the definition area of a_τ^c $(0 \leq a_\tau^c \leq 1)$ is not that straightforward if the following condition does not hold within the definition area: $\frac{\partial E\left[CF_{FA}^{Group}\right]}{\partial a_\tau^c} = 0$.

or

$a_\tau^c > \alpha_e$ and $n > \frac{1}{6}\left(6 + 3\,\mathrm{c}\,\cdot a_\tau^c - 4\,\mathrm{c}\cdot\, a_\tau^{c\,2} - 3\,c\cdot\alpha_e + 2\,\mathrm{c}\cdot\alpha_e\cdot a_\tau^c + 2\,\alpha_e{}^2 - 4\,u + 8\,p\,u\right)$. (15b)

However, the main goal of this analysis is to find out the optimal after-tax allocation of investment funds a_τ^{c*} (i.e. the allocation that leads to highest after-tax cash flows) in order to compare that allocation with the optimal pre-tax allocation. From this comparison we learn which tax allocation system has stronger distortional effects.

To draw economically meaningful conclusions given the rather complex models, we fall back on a numerical analysis. In a first step, we determine reasonable and realistic parameter settings. In subsection 4.4 we already explain reasonable values for the parameters p and u in line with recent pre-tax margins (median of 13%) of companies in various sectors. In the period 1990-2008 average transportation costs for industry and trade ranged between 7% and 27% of total costs.[37] To account for realistic tax rate differentials we take the highest and lowest tax rates within EU member states (i.e., Slovenia with 17% and France with 34.43%) for 2015.[38] As we believe that the fraction of income that the MNG is able to shift to the low-tax country A under SA is highly dependent on the industry and the characteristics of the MNG, we refrain from attaching a value to n. We apply the same argumentation for not attaching a value to the optimal pre-tax allocation of investment funds $\alpha_e{}^*$. In Fig. (1), we show for three levels ("low", "medium", "high") of $\alpha_e{}^*$ and n under which system the distortion of the optimal investment decisions is more severe. The vertical black line in Fig. (1) indicates the optimal pre-tax allocation of investment funds.

Fig. (1) shows the expected after-tax cash flows depending on the after-tax allocation of investment funds a_τ^c. The tax allocation system that leads to a bigger difference between the optimal pre-tax allocation of funds $\alpha_e{}^*$ and the optimal after-tax allocation of funds a_τ^c is identified as the more distortive system. Remember that the optimal after-tax allocation of funds is characterized by the maximal after-tax cash flows. The upper abbreviation (SA or FA) in the framed boxes above each graph indicates under which tax allocation system the distortions of the investment decision are greater. The lower abbreviation indicates which system leads to the higher expected after-tax cash flows in the optimum. The latter information is not directly relevant for our research question yet it is an interesting side note. The parameter constellations in Fig. (1) are chosen in such a way that, under optimal allocation of investment funds, the investment project is profitable under either system. Note that the curves for FA in Fig. (1) do not change with changing income-shifting possibilities (represented by the level of the transfer price n) as transfer pricing only exists under SA.

Fig. (1) shows that the distortions tend to be greater under SA than under FA for better possibilities of income-shifting (decreasing value of n) and for a higher share of funds that is optimally invested in

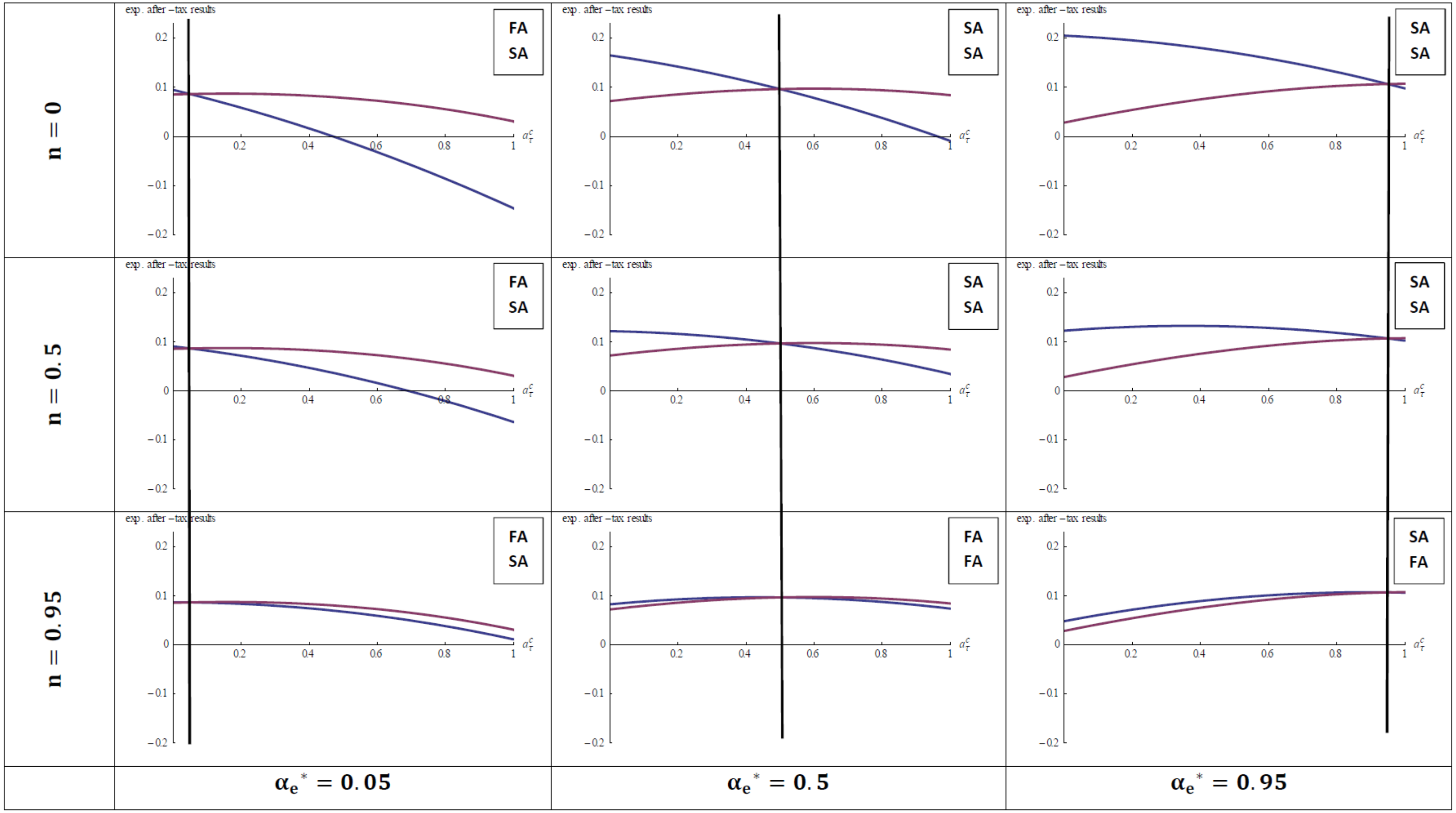
[37] Statista (2015).

[38] We use the combined corporate income tax rate. OECD (2015).

entity A in the pre-tax case (increasing value of $\alpha_e{}^*$) under SA. The income-shifting possibilities determine the level of distortion under SA. The better the income-shifting possibilities (the lower n), i.e., the stricter the local segregation of costs and sales, the more the MNG can benefit from a tax-favorable allocation of funds. Consequently, it is worthwhile for the MNG to deviate more from the optimal pre-tax allocation $\alpha_e{}^*$ to approach the optimal tax allocation $\alpha_\tau{}^*$ for its final investment decision (a_τ^{c*}). High transportation costs for a greater deviation from $\alpha_e{}^*$ are refunded by high tax savings in case of good income-shifting possibilities. Remember from the no-cost scenario in Section 4 that the optimal allocation of funds from a tax perspective is always extreme. Under SA the optimal allocation is $\alpha_\tau{}^* = 0$ while under FA it is $\alpha_\tau{}^* = 1$ in a profit situation.

The greater the difference between the unidimensional optima $\alpha_\tau{}^*$ and $\alpha_e{}^*$ under each tax allocation system, the greater the resulting distortions with respect to the final investment decision a_τ^{c*}. This is because due to the quadratic transportation costs the MNG surrenders only few pre-tax profits for a small deviation from $\alpha_e{}^*$ but greatly reduces its taxes by choosing an after-tax allocation of investment funds a_τ^{c*} that is closer to $\alpha_\tau{}^*$. The optimal investment decision a_τ^{c*} is reached if the marginal tax savings are equal to the marginal transportation costs. In line with that explanation, Fig. (1) shows that the distortions of the investment decisions are greatest under SA and lowest under FA for high values of $\alpha_e{}^*$. In such a case the difference between the unidimensional optima $(\alpha_e{}^*, \alpha_\tau{}^*)$ are highest under SA and lowest under FA. Vice versa, for low values of $\alpha_e{}^*$ the difference between the unidimensional optima $(\alpha_e{}^*, \alpha_\tau{}^*)$ is low under SA and high under FA and thus the distortion tends to be higher under FA.

The results do not change qualitatively with respect to the relative distortion caused by each tax allocation system if we vary the transportation costs c, the profitability (determined by p and u, as long as they ensure still a profitable setting) or the tax rate differential $(\tau_A - \tau_B)$ within economically reasonable ranges (see Appendix 1-3). However, in the following we change our setting from a profit to a loss scenario (changing the probability of a successful investment outcome p from 0.6 to 0.1, see Fig. (2)). To consider an investment project which results in an expected after-tax loss needs to be justified in our model set-up as a rational executive of an MNG would not invest in such a project from the outset.

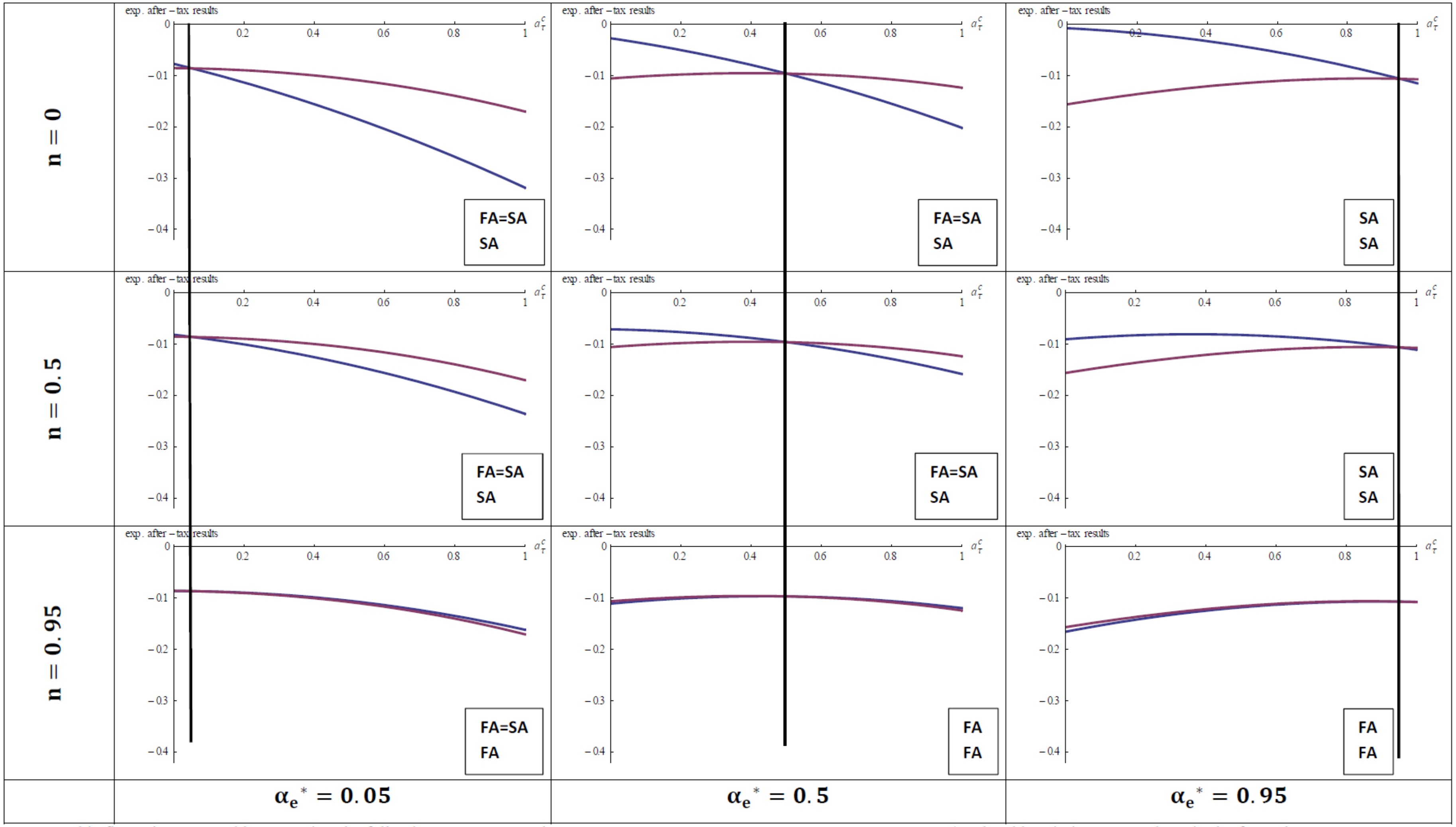


Notes: This figure is generated by assuming the following parameter setting: $c = 0.1, \tau_A = 0.17, \tau_B = 0.3443, p = 0.6, u = 0.65$. The abbreviations FA and SA in the framed boxes indicate which tax allocation system leads to more severe distortions of the investment decision (upper abbreviation) and which system results in the optimum in higher expected after-tax profits (after transportation costs).

Figure 1: Expected after-tax profits (after transportations costs) for varying values of transfer prices n and of the optimal pre-tax allocation of investment funds $\alpha_e{}^*$.

For example, the MNG may pursue a high-risk business model and invest in a number of highly risky projects. The MNG is aware that most of the projects could fail but hopes that one project brings forth a highly profitable final product. Consequently, the expected value for a single investment project may be negative even though the expected value for the whole portfolio is expected to be profitable. Furthermore, legal obligations or safety regulations could force the MNG to carry out an unprofitable investment. An example of such a safety regulation is the duty to equip certain machines with an emergency off-button. The MNG needs to undertake the investment to equip the machines with the required function but the investment is not expected to increase the demand for/the price of the product. Furthermore, by relaxing our strict assumption of a one-period model, the consideration of a (temporarily) unprofitable investment reflects a common scenario MNGs have to face. If we assume that we consider just the first period of an investment project with a multi-period life span, it is likely that the investment project will be loss-making in the initial stage (e.g., start-up projects). However, these losses are expected to be overcompensated by future profits. Our setting captures such investment projects in the first unprofitable periods. However, the MNG may attach greater weight to the expected initial losses in its investment decision as it is uncertain whether the project will ever be profitable in the future. Furthermore, favorable tax utilization conditions in the initial stage of a project could ensure the survival of the project in critical cases.

Fig. (2) shows that in the loss scenario, in five out of nine cases the final investment decisions (α_τ^{c*}) are distorted equally severe under both tax systems (in cases where the upper row in the framed boxes reads “FA=SA”). The reason for this is that in a loss scenario, under both tax allocation systems the expected tax refunds are highest if all funds are invested in the high-tax country B $(\alpha_\tau{}^* = 0)$. Thus, in a loss scenario both systems imply the same investment incentives from a tax base allocation perspective. Compared to the profit scenario, the shape of the curves under SA remain identical. Due to the assumed immediate and full loss-offset, the change in net cash flows of the MNG (from profit to loss) does not affect the optimal final investment decision (α_τ^{c*}) under SA. By contrast, under FA the optimal final investment decision (α_τ^{c*}) depends on the expected outcome from the investment project and thus the shape of the curves changes slightly compared to the profit scenario.



Notes: This figure is generated by assuming the following parameter settings: $c = 0.1, \tau_A = 0.17, \tau_B = 0.3443, p = 0.4, u = 0.65$. The abbreviations FA and SA in the framed boxes indicate which tax allocation system leads to more severe distortions of the investment decision (upper abbreviation) and which system results in the optimum in higher expected after-tax profits (after transportation costs).

SA

FA

Figure 2: Expected after-tax losses (after transportations costs) for varying values of transfer prices n and of the optimal pre-tax allocation of investment funds α_c .

6 Conclusions and implications

We examine which tax allocation system leads to more severe distortions with respect to locational investment decisions. While existing studies focus primarily on the impact of taxes on locational decisions under either separate accounting (SA) or formula apportionment (FA), the main innovation of this paper is that it compares both systems with regard to the level of distortions they induce. We model after-tax investment decisions of a centrally managed MNG under both tax allocation systems and take the optimal pre-tax investment decision as a given. The optimal pre-tax investment decision serves as a benchmark for the level of distortion caused by each system. Under SA, the MNG is assumed to have comprehensive income-shifting opportunities. We focus on an investment decision of an MNG that has already established business activities in the entities in which it invests.

We make the following contributions to the literature. First, in line with the results of Martini et al. (2013) yet in contrast to some commonly held views, we find that the application of transfer pricing under SA has real economic effects. As transfer prices offer the possibility to shift income within group entities, they allow – at least to some extent – the segregation of production and sales. This segregation impacts locational investment decisions. Second, the tax allocation systems differ in their ability to allow MNGs to make optimal investment decisions under cash flow uncertainty. Under SA, the tax-optimal investment decision is independent of whether the investment project is successful or not. By contrast, under FA the tax-optimal allocation of investment funds is completely reversed when the expected outcome of the investment project does not occur. Consequently, if the MNG allocates the funds between the entities on the basis of expected positive future cash flows but ultimately experiences a loss from the project, the allocation of the tax base is highly tax-unfavorable. Thus, in comparison to SA, FA is more likely to be crisis-intensifying.

Third, as an important extension of the literature, we show that both tax allocation systems imply opposing investment incentives with respect to locational investment decisions in a profit scenario. From a purely tax allocation perspective, the MNG expects lowest tax payments if it invests all funds in assets and labor in the high-tax country and shifts resulting sales via transfer prices to a low-tax country. By contrast, under FA the expected tax payments are lowest if as much funds as possible are invested in assets and labor in the low-tax country. Owing to the consolidation of profits and losses of all group entities, FA offers less scope for tax planning compared to SA with good income-shifting possibilities. The more profitable the MNG, the greater the incentives under FA to allocate the investment funds in a tax-optimal manner. Under SA, the MNG is more incentivized to allocate funds tax-optimally with the possibility to set tax-optimal (i.e., low) transfer prices. By applying realistic parameter settings, we find that the incentives for a tax-optimal allocation of funds are higher under SA than FA. This has a number of important policy implications, especially given the potential introduction of the CCCTB in Europe. Since the incentives to invest in a tax-optimal manner tend to be lower under FA, the tax-optimal allocation of funds is less important under that system. That is desirable from a tax policy perspective as it tends to distort pre-tax investment decisions to a lesser extent. However, only by considering specific optimal pre-tax investment decisions can we draw conclusions about the level of distortion caused by either system.

Finally, by introducing costs for the geographical segregation of production and sales, we can draw conclusions about the level of distortions induced by each tax allocation system. The distortions under SA tend to be more severe than under FA if a greater share of investment funds is to be invested in a low-tax country from a pre-tax perspective and the investment is profitable. In such a setting, the MNG would deviate rather strongly from the optimal pre-tax investment decision in order to benefit from a more tax-favorable environment. Such pre-tax investment decisions are typical for German MNGs (particularly those in the manufacturing industry) that invest e.g. in low-tax Eastern European countries to gain access to a low-wage workforce.[39] The after-tax investment decision tends to be distorted more severely under SA than under FA if comprehensive income-shifting opportunities under SA are assumed. Vice versa, pre-tax decisions that result in the investment of a big share of funds in the high-tax country tend to be distorted less under SA than under FA. R&D investments in the pharmaceutical industry may be a model for such pre-tax investment decisions. MNGs need highly skilled and well-educated workers and seek a very high level of legal certainty to maintain a hold over, e.g., their patents. Such conditions are typical for the European high-tax countries such as Germany, France, or Belgium.

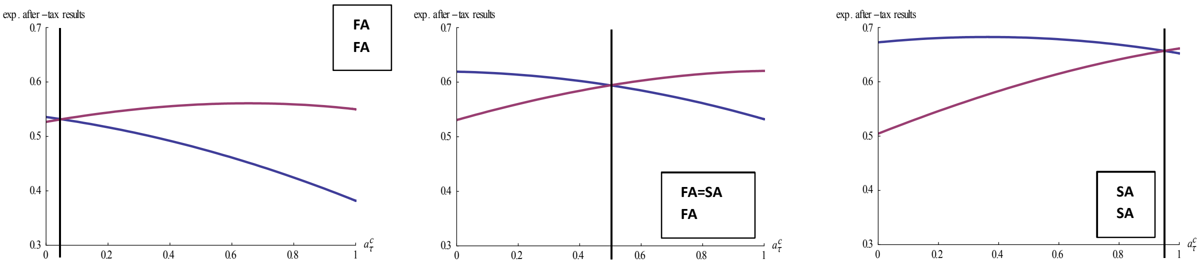
From our results we can derive some important policy implications. The introduction of the CCCTB in Europe may have a tremendous impact on locational investment decisions and the shifting of economic substance to low-tax countries.[40] It depends on the sector in question how well an MNG is able to adjust the company structure to reverse investment incentives under FA. While a company in the manufacturing industry may be able to easily adjust to incentives offered by FA, companies in the pharmaceutical industry may find this more difficult.

Our findings must be interpreted against the background of our set of assumptions. Our results are driven by the assumption that MNGs have ample opportunity to shift income to low-tax countries under SA. Even if we validate this assumption by empirical, anecdotal, and analytical evidence, it may not be appropriate for all MNGs. Several important issues have not yet been sufficiently addressed. It is a rather strong assumption to assume quadratic transportation costs. It would be desirable to test our results under different cost functions, too. Furthermore, it would be interesting to examine distortional effects under both tax allocation systems if the assumption of a direct loss-offset is dropped.

[39] See Devereux (2008), p. 636.
[40] See Devereux (2008), p. 636.

Appendix 1): Increase in profitability (p, u)

For reasons of comparability the parameter settings are equal to that of the graphs in the second row of Fig. (1) ($n = 0.5$) with the exception of profitability (here $p = 0.9$, $u = 1$). The parameter settings result in a pre-tax profit margin (before transportation costs) of 90%, which is absolutely exceptional. Note the changed values of the y-axis compared to Fig. (1).



$\alpha_e^* = 0.05$ $\alpha_e^* = 0.5$ $\alpha_e^* = 0.95$

Notes: This figure is generated by assuming the following parameter settings: $n = 0.5, c = 0.1, \tau_A = 0.17, \tau_B = 0.3443, p = 0.9, u = 1$. The abbreviations FA and SA in the framed boxes indicate which tax allocation system leads to more severe distortions of the investment decision (upper abbreviation) and which one results in the optimum in higher expected after-tax profits (after transportation costs).

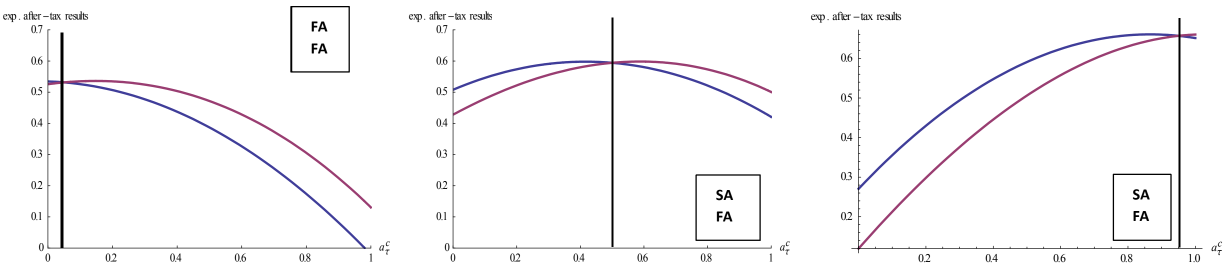
SA
FA

Figure 3: Expected after-tax profits (after transportations costs) for varying values of the optimal pre-tax allocation of investment funds α_e^*.

The increased profitability benefits the relative advantageousness of FA compared to SA with respect to the after-tax results. However, not even in this extreme case (pre-tax profit margin of 90%) is the rank order of the tax allocation systems changed with respect to their distortive power.

Appendix 2: Increased transportation costs c

For reasons of comparability the parameter settings are equal to that of the graphs of Fig. (3) with exception of the transportation costs (here $c = 0.7$). We need a highly profitable situation (like in Fig. (3)) to assume high transportation costs and remain in a profitable setting in the optimum. Note the changed values of the y-axis compared to Fig. (3).



$\alpha_e^* = 0.05$ $\alpha_e^* = 0.5$ $\alpha_e^* = 0.95$

Notes: This figure is generated by assuming the following parameter settings: $n = 0.5, c = 0.7, \tau_A = 0.17, \tau_B = 0.3443, p = 0.9, u = 1$. The abbreviations FA and SA in the framed boxes indicate which tax allocation system leads to more severe distortions of the investment decision (upper abbreviation) and which one results in the optimum in higher expected after-tax profits (after transportation costs).

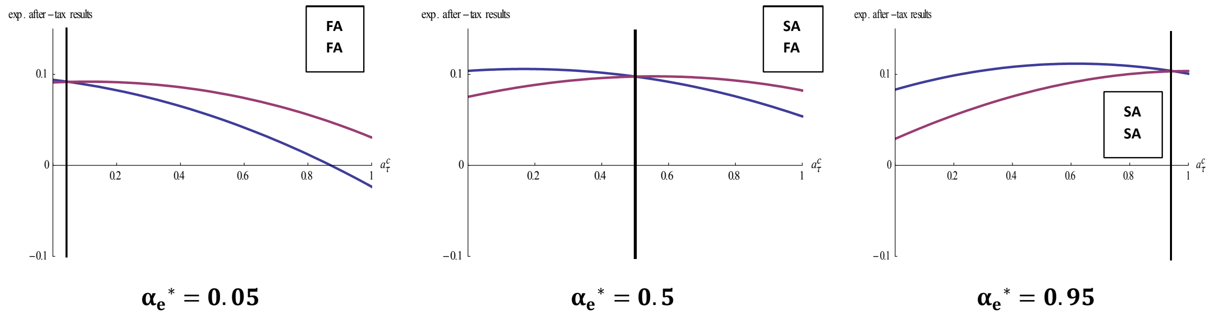
SA
FA

Figure 4: Expected after-tax profits (after transportations costs) for varying values of the optimal pre-tax allocation of investment funds α_e^*.

Due to the increased transportation costs, the expected after-tax profits decrease more strongly with a greater distance between $\alpha_e{}^*$ and α_τ^c. Thus, the curves under both tax allocation systems are more pronounced. The rank order of both systems does not change with respect to their distortive impact.

Appendix 3: Decreased tax rate differential $(\tau_A - \tau_B)$

For reasons of comparability the parameter settings are equal to that of the graphs in the second row of Fig. (1) ($n = 0.5$) with exception of the tax rates (here $\tau_A = 0.2$, $\tau_B = 0.3$). Since we have chosen the most extreme tax rates (France and Slovenia), in this setting we want to account for more moderate tax rate differentials. Note the changed values of the y-axis compared to Fig. (1).



Notes: This figure is generated by assuming the following parameter settings: $n = 0.5, c = 0.1, \tau_A = 0.2, \tau_B = 0.3, p = 0.6, u = 0.65$. The abbreviations FA and SA in the framed boxes indicate which tax allocation system leads to more severe distortions of the investment decision (upper abbreviation) and which system results in the optimum in higher expected after-tax profits (after transportation costs).

Figure 5: Expected after-tax profits (after transportations costs) for varying values of the optimal pre-tax allocation of investment funds $\alpha_e{}^*$.

Fig. (5) shows that the difference between the expected after-tax results decreases between both tax allocation systems. There is no change with respect to the rank order of distortional impact under each system.

References

Altshuler, Rosanne/Grubert, Harry (2010): Formula Apportionment: Is it better than the current system and are there better alternatives? In: National Tax Journal, Vol. 63, pp. 1145-1184.

Andree, Kai (2014): Horizontale Fusionen bei räumlichem Wettbewerb. Schöler, Klaus (ed.). Universitätsverlag Potsdam, 2014, Potsdam.

Bartelsman, Eric J./Beetsma, Roel M. W. J. (2003): Why pay more? Corporate tax avoidance through transfer pricing in OECD countries. In: Journal of Public Economics, Vol. 87, pp. 2225-2252.

Becker, Johannes/Fuest, Clemens (2007): Quality versus Quantity - The Composition Effect of Corporate Taxation on Foreign Direct Investment. CESifo Working Paper No. 2126.

Becker, Johannes/Fuest, Clemens/ Riedel, Nadine (2012): Corporate tax effects on the quality and quantity of FDI. In: European Economic Review, Vol. 56, pp. 1495-1511.

Bénassy-Quéré, Agnès/Fontagné, Lionel/Lahrèche-Révil, Amina (2005): How Does FDI React to Corporate Taxation? In: International Tax and Public Finance, Vol. 12, pp. 583-603.

Bettendorf, Leon et al (2010): Corporate tax harmonization in the EU. In: Economic Policy, July 2010, pp. 539-590.

Binckebanck, Lars (2012): Internationaler Vertrieb – Grundlagen, Konzepte und Best Practices für Erfolg im globalen Geschäft. In Christian Belz (ed.). Springer Gabler, 2012, Wiesbaden.

Binet, Marie-Estelle (2008): Optimal local taxation and French municipal tax distortions. In: Applied Economics, Vol. 40, pp. 327-332.

Buettner, Thiess (2002): The impact of taxes and public spending on the location of FDI: Evidence from FDI-flows within Europe. ZEW Discussion Paper 02-17, Mannheim.

Buettner, Thiess/Wamser, Georg (2013): Internal debt and multinational profit shifting: Empirical evidence from firm-level panel data. In: National Tax Journal, Vol. 66, pp. 63-96.

Clausing, Kimberly A. (2009): Multinational firm tax avoidance and tax policy. In: National Tax Journal, Vol. 62, No. 4, pp. 703-725.

CSI market (2015): Pre-tax margin screening. Web. 22 Oct. 2015. http://csimarket.com/screening/index.php?s=pm&pageS=4&fis= (date of last access: 22 Oct 2015).

Dahle, Claudia (2011): Der Einfluss von Mindestbesteuerungskonzepten auf unternehmerische Investitionsentscheidungen unter Berücksichtigung grenzüberschreitender Gruppenbesteuerungs-systeme. Verlag Dr. Kovač, 2011, Hamburg.

Devereux, Michael P./Griffith, Rachel (1998): Taxes and the location of production: evidence from a panel of US multinationals. In: Journal of Public Economics, Vol. 68, pp. 335-367.

Devereux, Michal P./Maffini, Giorgia (2006): The Impact of Taxation on the Location of Capital, Firms and Profit: A Servey of Empirical Evidence. Oxford University Centre for Business Taxation WP 07/02.

Devereux, Michael P. (2008): Business taxation in a globalized world. In: Oxford Review of Economic Policy, Vol. 24, pp. 625-638.

Dharmapala, Dhammika (2014): What Do We Know about Base Erosion and Profit Shifting? A Review of the Empirical Literature. Coase-Sandor Institute for Law and Economics, Working Paper No. 702.

Dietrich, Maik/Kiesewetter, Dirk (2007): Auswirkungen einer Common Consolidated Tax Base bei Investitionsentscheidungen der Multinationalen Unternehmung. In: Betriebswirtschaftliche Forschung und Praxis, Vol. 59, pp. 498-516.

Dietrich, Maik/Kiesewetter, Dirk (2011): Simultane Investitions- und Finanzierungsentscheidungen einer multinationalen Unternehmung bei Anwendung des Einheitsprinzips. In: Betriebswirtschaftliche Forschung und Praxis, Vol. 63, pp. 101-117.

Dischinger, Matthias/Knoll, Bodo/Riedel, Nadine (2014): The role of headquarters in multinational profit shifting strategies. In: International Tax and Public Finance, Vol. 21, pp. 248-271.

Dyreng, Scott/Markle, Kevin (2013): The Effect of Financial Constraints on Tax-Motivated Income Shifting by U.S. Multinationals. DOI: http://dx.doi.org/10.2139/ssrn.2336799.

Egger, Peter/Eggert, Wolfgang/Winner, Hannes (2010): Saving taxes through foreign plant ownership. In: Journal of International Economics, Vol. 81, pp. 99-108.

European Commission (2011): Proposal for a Council Directive on a Common Consolidated Corporate Tax Base (CCCTB). COM (2011) 121/4.

Feld, Lars P. (2000): Steuerwettbewerb und seine Auswirkungen auf Allokation und Distribution – Ein Überblick und eine empirische Analyse für die Schweiz. Mohr Siebeck, 2000, Tübingen.

Fuest, Clemens (2008): The European Commission's proposal for a common consolidated corporate tax base. In: Oxford Review of Economic Policy, Vol. 24, pp. 720-739.

Fuest, Clemens/Hemmelgarn, Thomas/Ramb, Fred (2007): How would the introduction of an EU-wide formula apportionment affect the distribution and size of the corporate tax base? An analysis based on German multinationals. In: International Tax and Public Finance, Vol. 14, pp. 605-626.

Gordon, Roger/Wilson, John D. (1986): An Examination of Multijurisdictional Corporate Income Taxation under Formula Apportionment. In: Econometrica, Vol. 54, pp. 1357-1373.

Gorter, Joeri/Parikh, Ashok (2003): How sensitive is FDI to differences in corporate income taxation within the EU? In: De Economist Vol. 151, pp. 193-204.

Goolsbee, Austan/Maydew, Edward L. (2000): Coveting thy neighbor`s manufacturing: The dilemma of state income apportionment. In: Journal of Public Economics, Vol. 75, pp.125-143.

Grubert, Harry (2003): Intangible Income, Intercompany Transactions, Income Shifting, and the Choice of Lacation. In: National Tax Journal, Vol. 56, pp. 221-242.

Grubert, Harry/Mutti, John (1991): Taxes, Tariffs and Transfer Pricing in Multinational Corporate Decision Making. In: The Review of Economics and Statistics, Vol. 73, pp. 285-293.

Grubert, Harry/Slemrod, Joel (1998): The Effect of Taxes on Investment and Income Shifting to Puerto Rico. In: Review of Economics and Statistics, Vol. 73, pp. 365-373.

Harris, David/Morck, Randall/Slemrod, Joel/Bernard Yeung (1993): The Impact of US tax law revision on multinational companies. In: Journal of Accounting Research (Supplement), Vol. 31, pp. 111-140.

Haufler, Andreas/Stähler, Frank (2013): Tax Competition a Simple Model with Heterogeneous Firms: How larger Markets reduce Profit Taxes. In: International Economic Review, Vol. 54, pp. 665-692.

Heckemeyer, Jost H./Overesch, Michael (2013): Multinationals' Profit Response to Tax Differentials: Effect Size and Shifting Channels. ZEW Discussion Paper No. 13-045, Mannheim.

Hong, Qing/Smart, Michael (2009): In praise of tax havens: International tax planning and foreign direct investment. In: European Economic Review, Vol. 54, pp. 82-95.

Huizinga, Harry/Laeven, Luc (2007): International profit shifting within multinationals: A multi-country perspective. In: Journal of Public Economics, Vol. 92, pp. 1164-1182.

ICC Germany (2015): ICC Incoterms 2010. Web. 22 Oct. 2015. http://www.iccgermany.de/icc-regeln-und-richtlinien/icc-incotermsR-2010-ueberblick.html (date of last access: 22 Oct. 2015).

Jara Diaz, Sergio R. (1982): The estimation of transport costs function: a methodological review. In: Transport Reviews, Vol. 2, pp. 257-278.

Kiesewetter, Dirk/Steigenberger, Tobias/Stier, Matthias (2014): Can formula apportionment really prevent multinational enterprises from profit shifting? – The role of asset valuation, intragroup debt and leases. arqus Discussion Paper No. 175.

Kruschwitz, Lutz/Schneider, Dirk/Husmann, Sven (2003): Investitionsneutrale Steuersysteme unter Sicherheit. In: Wissenschaftliches Studium, Vol. 32 (2003), pp. 328-333.

Mintz, Jack/Smart, Michael (2004): Income shifting, investment, and tax competition: theory and evidence from provincial taxation in Canada. In. Journal of Public Economics, Vol. 88, pp. 1149-1168.

Nielsen, Søren Bo/Raimondos-Møller, Pascalis/Schjelderup, Guttorm (2003): Formula Apportionment and Transfer Pricing under Oligopolistic Competition. In: Journal of Public Economic Theory, Vol. 5, pp. 419-437.

Nielsen, Søren Bo/Raimondos-Møller, Pascalis/Schjelderup, Guttorm (2010): Company taxation and tax spillovers: Separate accounting versus formula apportionment. In: European Economic Review, Vol. 54, pp. 121-132.

OECD (2013): Action Plan on Base Erosion and Profit Shifting. OECD Publishing, Paris 2013. DOI: http://dx.doi.org/10.1787/9789264202719-en.

OECD (2015): OECD.Stat – Corporate Income Tax Rate. Web. 22. Oct. 2015. http://stats.oecd.org//Index.aspx?QueryId=58204 (date of last access: 22 Oct 2015).

Oestreicher, Andreas/Koch, Reinald (2011): The Revenue Consequences of Using a Common Consolidated Corporate Tax Base to Determine Taxable Income in the EU Member States. In: FinanzArchiv, Vol. 67, pp. 64-102.

Ortmann, Regina/Sureth-Sloane, Caren (2016): Can the CCCTB Alleviate Tax Discrimination against Loss-making European Multinational Groups? In: Journal of Business Economics, forthcoming.

Overesch, Michael (2009): The Effects of Multinationals' Profit Shifting Activities on Real Investments. In: National Tax Journal, Vol. 62, pp. 5-23.

Runkel, Marco/Schjelderup, Guttorm (2011): On the Choice of Apportionment Factors under Formula Apportionment. In: International Economic Review, Vol. 52(3), pp. 913-934.

Schaefer, Waldemar (1993): BMW zahlt kaum noch Ertragsteuern im Inland. Zu Lasten des Staates. In: Handelsblatt, 26.03.1993, p. 2.

Statista (2015): Anteil der Logistikkosten an den Gesamtkosten. http://de.statista.com/statistik/daten/studie/6346/umfrage/anteil-der-logistikkosten-an-den-gesamtkosten/ (date of last access: 22 Oct. 2015).

Uniform Division of Income for Tax Purposes Act (1966). Web 3. Nov. 2015. http://www.uniformlaws.org/shared/docs/uditpa/uditpa66.pdf (date of last access: 3 Nov. 2015).

Weichenrieder, Alfons (1996): Fighting International Tax Avoidance: The case of Germany. In: Fiscal Studies, Vol. 17, pp. 37-58.